Biological Results of the Strait of Georgia Spiny Dogfish (*Squalus Acanthias*) Longline Surveys Conducted in October 1986 and 1989

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BIOLOGICAL RESULTS OF THE STRAIT OF GEORGIA SPINY DOGFISH (*Squalus Acanthias*) LONGLINE SURVEYS CONDUCTED IN OCTOBER 1986 AND 1989

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ABSTRACT

McFarlane, G.A., King, J.R, Hodes, V.R., and Andrews, W.T. 2005. Biological results of the Strait of Georgia spiny dogfish (*Squalus Acanthias*) longline surveys conducted in October 1986 and 1989. Can. Manuscr. Rep. Fish. Aquat. Sci. 2736: iii + 42p.

From October 10 to 26, 1986 and October 15 to 30, 1989 the *F/V Velma C* was chartered to conduct spiny dogfish (*Squalus acanthias*) longline surveys in the Strait of Georgia. Fishing occurred at fourteen sites selected to be representative of commercial fishing areas: Active Pass, Porlier Pass, Sturgeon Bank, Entrance Island, Halibut Bank, French Creek, Hornby Island, Ajax and Exeter Shoals, Cape Lazo, Oyster River, Cape Mudge, Grants Reef, Sinclair Bank and Epson Point. Five depth strata were fished during both surveys: 0 to 55m, 56 to 110m, 111 to 165m, 166 to 220m and deeper than 220m. All captured spiny dogfish were measured for length, sex and maturity. Second dorsal spines were removed for age estimation. The overall catch rate (CPUE; fish per thousand hooks) in 1989 was higher than in 1986. The increase in CPUE was greater for female spiny dogfish than for males. Estimated ages of spiny dogfish ranged from 7-97 years. This information will provide a basis for examining future abundance trends.

RESUME

McFarlane, G.A., King, J.R, Hodes, V.R. and Andrews, W.T. 2005. Biological results of the Strait of Georgia spiny dogfish (*Squalus Acanthias*) longline surveys conducted in October 1986 and 1989. Can. Manuscr. Rep. Fish. Aquat. Sci. 2736: iii + 42p.

Le navire *F/V Velma C* a été affrété du 10 au 26 octobre 1986 et du 15 au 30 octobre 1989 pour effectuer des relevés à la palangre de l'aiguillat commun (*Squalus acanthias*) dans le détroit de Georgie. La pêche s'est déroulée à quatorze sites sélectionnés comme étant représentatifs des zones de pêche commerciale : passage Active, passage Porlier, banc Sturgeon, île Entrance, banc Halibut, embouchure du ruisseau French, île Hornby, hauts-fonds Ajax et Exeter, cap Lazo, embouchure de la rivière Oyster, cap Mudge, récif Grants, banc Sinclair et pointe Epson. Durant les deux relevés, la pêche a été pratiquée à cinq strates de profondeur, soit de 0 à 55 m, de 56 à 110 m, de 111 à 165 m, de 166 à 220 m et à plus de 220 m. On a mesuré la longueur de tous les aiguillats capturés et on en a déterminé le sexe et l'état de maturité. On a prélevé la deuxième épine dorsale pour estimer l'âge des poissons. Le taux de capture global (CPUE : poissons capturés par mille hameçons) a été plus élevé en 1989 qu'en 1986. La hausse des CPUE a été plus forte pour les aiguillats femelles que pour les mâles. L'âge estimé des aiguillats a varié de sept à 97 ans. Ces données serviront de référence pour étudier l'évolution future de l'abondance.

INTRODUCTION

Spiny dogfish (Squalus Acanthias) were an important component of Canada's Pacific fishery from the late 1800s to the mid 1950s (Ketchen 1986). A resurgence in interest in the fishery led to an increase in catches in the late 1970s, particularly in the Strait of Georgia. Based on tagging studies (McFarlane and King, 2002), the Strait of Georgia stock is considered to be discreet. The recent increase in fishing catches in the late 1970s prompted the initiation of an assessment program. As part of this program two longline surveys were conducted: 1986 and 1989. The purpose of these surveys was to develop survey methodology and to provide base line biological and catch effort data for fishing sites in the Strait of Georgia. This information would provide a basis for examining future abundance trends. Recent concerns regarding the exploitation of elasmobranch species have highlighted the need provide data summaries from these surveys for current assessment work.

METHODS

The longline surveys were conducted from October 10 to 26, 1986 and October 15 to 30, 1989. The vessel *F/V Velma C* (17m) was chartered for both surveys.

In 1986 and 1989, longline fishing occurred at fourteen sites throughout the Strait of Georgia (Figures 1 and 2) selected to be representative of commercial fishing sites. The sites included: east of Active Pass, east of Porlier Pass, Sturgeon Bank, Entrance Island, Halibut Bank, French Creek, east of Hornby Island, near Ajax and Exeter Shoals, off Cape Lazo, Oyster River, Cape Mudge, Grants Reef, Sinclair Bank and Epson Point. In each survey, weather permitting, the sites were fished in the same order at five depth strata:

1: 0 to 55m,
2: 56 to 110m,
3: 111 to 165m,
4: 166 to 220m and
5: deeper than 220m.

At each site, the depth ranges were fished in random order. If time permitted a duplicate set was made each day at one depth stratum at the site. If a set was placed over two depth strata it was not used in CPUE analyses.

Once the vessel arrived at the pre-selected site the appropriate depth range was located and fishing proceeded along the contour. All fishing gear and bait was provided by Fisheries and Oceans Canada. A complete description of the longline gear is in Appendix 1.

Each longline set consisted of a leaded groundline (3/8 inches in diameter) attached to an anchored buoyline at each end. Model 72 snaps (3 cm in width; 13 cm in length), made from 3.2 mm stainless steel wire were attached to the groundline with a

spacing of 2 m. Snap gangions (two ply braided nylon) 30 cm long were fitted with #12/0 stainless steel Mustad J hooks.

Each groundline was typically deployed with 500 hooks per set baited with frozen herring. This number was decreased if prior fishing in the area indicated high catch rates or in the event that the target depth range could not be maintained. The effective fishing time for each set was recorded as the time from when the first hook was deployed until the last hook was retrieved. In order to minimize bias in catch rates due to differences in effective fishing time, all longline sets were fished for 1.5-3 hours. Catch per unit effort (CPUE) for a longline set was calculated as the total number of spiny dogfish caught per thousand hooks.

Length, sex and maturity were recorded from all captured spiny dogfish. Length was determined as the total length of the fish; from the tip of the snout to the tip of the upper lobe of the caudal when it was directed downward in a straight line with the body. Sex was determined externally, maturity internally. Second dorsal spines were removed for ageing (Beamish and McFarlane 1985) and stored individually in pre-numbered envelopes. Spines were frozen onboard, later thawed, air dried and stored. A random sub-sample of second dorsal spines from each survey year was read for age estimation (1986 from Porlier Pass and Halibut Bank) (1989 from Entrance Island, Hornby Island, AjaxExeter Shoal, Grants Reef, Sinclair Bank, Cape Mudge, Oyster River, Cape Lazo and Epson Point). Other species were identified and counted then immediately released.

Stage of maturity was recorded for all captured spiny dogfish. Maturity stages are described in Appendix 2. Briefly, the female maturity has two stages, one describing the condition of the ovary and a second describing the condition of the uteri. Males were grouped into 3 categories; immature, maturing and mature. Females were grouped into 16 categories with 4 for immature fish, 6 for maturing and 6 for mature fish. A separate description was applied for fish that had both male and female attributes

Fecundity information including numbers of large ovarian eggs, large ovarian egg diameters (mm), and yolk-sac pup total lengths (mm) was recorded when large eggs (>35mm diameter) were encountered either in the ovaries or encapsulated in the uterus. For each spiny dogfish at this maturity level, measurements were taken from three randomly selected large ovarian eggs and three yolk-sac pups.

RESULTS

During October 10-26, 1986, 37,710 hooks were set over 77 sets in 14 sites: 5 sets at Active Pass; 5 at Porlier Pass; 6 at Sturgeon Bank; 7 at Entrance Island; 7 at Halibut Bank; 6 at French Creek; 5 at Hornby Island; 6 at Ajax-Exeter Bank; 6 at Cape Lazo; 4 at Oyster River; 5 at Cape Mudge; 5 at Grants Reef; 6 at Sinclair Bank and 4 at Epson Point (Figure 1). Mean effective fishing time was 147 minutes. A total of 8058 spiny dogfish were sampled (Table 1). Yelloweye rockfish (*Sebastes ruberrimus*), quillback rockfish (*S. maliger*) and ratfish (*Hydrolagus colliei*) were the most frequent finfish encountered (Table 1).

During October 15-30, 1989, 34,221 hooks were set over 69 sets in14 sites: 5 sets at Active Pass; 4 at Porlier Pass; 5 at Sturgeon Bank; 5 at Entrance Island; 5 at Halibut Bank; 5 at French Creek; 5 at Hornby Island; 6 at Ajax-Exeter Bank; 5at Cape Lazo; 5 at Oyster River; 4 at Cape Mudge; 5 at Grants Reef; 5 at Sinclair Bank and 5 at Epson Point (Figure 2). Mean effective fishing time was 146 minutes. A total of 10,321 spiny dogfish were sampled (Table 2). Yelloweye rockfish (*Sebastes ruberrimus*), quillback rockfish (*S. maliger*) and ratfish (*Hydrolagus colliei*) were the most frequent finfish encountered (Table 2).

CATCH PER UNIT EFFORT

The mean 1986 CPUE (fish/1000 hooks) for spiny dogfish was 213.7 and CPUE by site ranged from 84.3 to 365.1. For male spiny dogfish the mean CPUE was 165.7; for female spiny dogfish it was 47.9 (Table 4). Sites with the highest overall dogfish CPUE were Cape Mudge, Grants Reef and Cape Lazo; with the lowest CPUE at the French Creek and Hornby Island sites. Female spiny dogfish CPUE was highest at Sinclair Bank and Epson Point; male spiny dogfish CPUE was highest at Cape Mudge and Cape Lazo (Table 4). CPUE varied by depth (Figure 3). Male spiny dogfish CPUE increased by depth through stratum 1 to 4 and decreased in depth stratum 5. For female spiny dogfish the CPUE was highest in depth stratum 1 and 2 then decreasing in depth stratum 3. Depth stratum 4 shows a CPUE increase for female spiny dogfish however the lowest CPUE was in depth stratum 5. One set from both Halibut Bank and Ajax-Exeter Bank that crossed two depth strata were eliminated from the 1986 catch rate summaries (Table 5).

The mean 1989 CPUE (fish/1000 hooks) for spiny dogfish was calculated to be 301.4 ranging from 159.2 to 454.2. For male spiny dogfish the mean CPUE was 212; for female spiny dogfish it was 87.8 (Table 4). Sites with the highest overall CPUE were Sturgeon Bank, Halibut Bank and Cape Mudge; with the lowest CPUE at the Active Pass and Hornby Island sites (Table 4). CPUE varied by depth following the same pattern as in 1986 (Figure 4). Male spiny dogfish CPUE increased with depth, peaking in depth stratum 4 then decreasing in depth stratum 5. Female spiny dogfish CPUE decreased as depth increased with the greatest proportion of catch in the two shallowest depth strata and the

smallest proportion of catch in depth stratum 5. The catch did not increase in depth stratum 4 as in 1986. Two sets from the Halibut Bank sampling site that crossed two depth strata were eliminated in the 1989 catch rate summaries (Table 5).

The overall catch rate (CPUE) in 1989 was higher than in 1986 (Table 4). The increase in CPUE was greater for female spiny dogfish than for males (Table 4). The increase in CPUE was observed at each site, except Active Pass, Cape Mudge and Grants Reef where the CPUE declined in 1989 (Table 4). The mean total length (cm) of spiny dogfish was lower in 1989 (80 cm) than in 1986 (81.9 cm) (Table 4). The mean size of both the female and males decreased in 1989 by 3 and 1.5 cm respectively.

LENGTH FREQUENCY

Detailed length frequency data by sex and site for 1986 and 1989 spiny dogfish catch is presented in Table 3 and Figure 5. Length and sex was recorded for 8058 spiny dogfish in 1986 and 10320 spiny dogfish in 1989.

In 1986, 6252 male and 1806 female spiny dogfish were sampled (Table. 3). Male spiny dogfish ranged in size from 35.8-103.6 cm with a mean length of 80.8 cm (Table 6). Female spiny dogfish ranged in size from 46.6-120.2 cm with a mean length of 83.26 cm (Table 3).

In 1989, 7312 male and 3008 female spiny dogfish were sampled (Table 3). Male dogfish ranged in size from 19.0 -98.4 cm with a mean length of 78.8 cm (Table 6). Female spiny dogfish ranged in size from 29.2-119.9 cm with a mean length of 82 cm (Table 6).

Excluding sets that spanned two depth intervals, in 1986 and 1989, mean female dogfish size decreased with increasing depth. The largest female dogfish from both years were caught in depth stratum 1; the smallest caught in depth stratum 5 (Table 5). Mean male spiny dogfish varied only slightly within depth strata, the smallest male dogfish caught in depth stratum 2 in 1986 and depth stratum 1 in 1989.

SEX DISTRIBUTION BY AREA

In 1986, with the exception of Epson Point and Sinclair Bank, all sites had significantly larger overall catch rates for male spiny dogfish. The same was true for most (11) sites in 1989 with only Epson Point, Sinclair Bank and Entrance Island having higher catch rates of female spiny dogfish (Table 4; Figure 6).

AGE

A sub-sample of second dorsal spines taken from female spiny dogfish during the 1986 longline cruise and a sub-sample of both male and female spines from the 1989 surveys were selected for age estimation.

From the 1986 survey, 207 spines taken from female spiny dogfish were aged.

Estimated age for female dogfish ranged from 21-82 years with lengths from 64.6 cm to 120.2 cm. The estimated oldest and youngest ages correspond to the shortest and longest length. The modal age of female dogfish was estimated to be 38 years (Figures 7 and 9).

From the 1989 survey, 901 spines were selected for age estimation, 569 from female dogfish (Figures 7 and 9) and 332 from male dogfish. (Figures 8 and 10). Male spiny dogfish ranged in age from 7 to 72 years; female spiny dogfish ranged in age from 7 to 97 years. The modal ages for male spiny dogfish were estimated to be 36 and 40 years. For female spiny dogfish the modal age was estimated to be 38 years. The oldest male was estimated to be 72 with a length of 93 cm; the youngest male was estimated to be 7 years with a length of 40 cm. The largest male aged was 93 cm corresponding to an estimated age of 35 years; the smallest male aged was 40 cm corresponding to an estimated age of 7 years (Figure 10).The oldest female was estimated to be 97 years with a length of 97.8 cm; the youngest female was estimated to be 7 years with a length of 40 cm. The largest female aged was 120 cm corresponding to an estimated age of 65 years; the smallest was 40 cm corresponding to an estimated age of 8 years (Figure 9).

MATURITY

All sampled dogfish were assessed for maturity condition (full description of maturity condition in Appendix 2). Mature female spiny dogfish were found to be more abundant in the two shallowest depth strata (Table 7).

In 1986, 23% of females were first time spawners, 27% second time spawners and 50% immature. For the males 87.3% were mature and 12.3% immature. In 1989, 26.7% of females were first time spawners, 11.3% second time spawners and 62% were immature. For the males 83% were mature; 17% were immature. These observations are based on maturity criteria developed in 1976 by Beamish and Smith.

The age at 50% maturity for female dogfish in the Strait of Georgia is estimated to be 35.5 years (Saunders and McFarlane 1993). Based on ages determined from 1986 dogfish samples, 85.5% of aged females had reached 50% maturity at the time of capture. This percentage was lower for female dogfish in 1989; based on estimated ages only 77.4% of aged females had reached 50% maturity at the time of capture (Figure 9).

FECUNDITY

Estimated size of ova found in the ovary was recorded for all female dogfish sampled on both surveys. A sub-sample of large egg diameter and pup lengths was taken.

In 1986, 490 female dogfish had small ova < 5mm in diameter, 415 female dogfish had ova 5-10mm in diameter, 479 fish had large yellow ova <30mm in diameter, and 409 had large yellow ova >30 mm in diameter in the ovary. 249 females had ova < 30mm with pups and 377 fish had ova > 30mm with pups in the uterus. The length of female dogfish with pups ranged from 80.9 to120.2 cm. The quantity of ova ranged from 2-16 per dogfish with the average number of ova equal to 7.2 per fish (Table 8).

In 1986, 271 uterine pups were measured. There were two distinct size ranges of pups. The first pup size range was from 85 to 140 mm corresponding to a mid-term pup with the yolk sac still visible; the second size range was 222-279 mm corresponding to a full-term pup with the yolk sac resorbed (Ketchen 1972). The modal pup length from the smaller size class was 110 mm. The modal pup length of the larger size class was 256 mm. (Figures 11 and 12).

In 1989, 1563 female dogfish had ova < 5 mm in diameter, 334 female dogfish had ova 5-10 mm in diameter, 772 had large yellow ova <30mm in diameter, 338 had large yellow ova >30mm in diameter present in their ovaries. 599 dogfish had ova <30mm with pups and 317 had ova >30mm with pups in the uterus. The size range of female dogfish with pups was 81.8 to 114.1cm.

In 1989, dogfish length and corresponding quantity of large ova > 30mm was recorded for 341 female dogfish. The size range of female dogfish was slightly smaller 79.9-114.1 cm than in 1986 though the average number of ova increased slightly to 7.6 per fish. The range of ova abundance 1989 was 3-16 per female. (Table 8).

Of 181 uterine pups measured during the 1989 survey, only a large size range, 236-292 mm, was observed. With the modal pup length at 255 mm, these pups correspond to full-term spiny dogfish pups (Figure 12) (Ketchen 1972).

DISCUSSION

Overall, CPUE was higher in 1989 than in 1986 (11 of 14 sites). In both 1986 and 1989, female spiny dogfish CPUE generally decreased with increasing depth; male spiny dogfish CPUE increased with increasing depth. The mean length for both male and female spiny dogfish decreased in 1989. There was an increase in immature dogfish captured in 1989 and fewer mature females carrying pups. The size range of in uteri dogfish pups corresponded to mid-term and full-term pups in 1986 and only full term pups in 1989. Spiny dogfish estimated ages ranged from 7 to 97 years: 7 to 72 years for males and 7 to 97 years for females. This information can be used to provide a basis for examining current and future spiny dogfish dynamics and abundance trends in the Strait of Georgia.

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Table 1. Number of fish caught by species during the October 1986 spiny dogfish survey. Species include: Spiny dogfish (*Squalus acanthias*), Ratfish (*Hydrolagus colliei*), Skate(*Rajidae*), Longnose skate (*Raja rhina*), Big skate (*R. binoculata*), Black skate (*R. kincaidi*), Brown catshark (*Apristurus brunneus*), Pacific Hake (*Merluccius productus*), Lingcod (*Ophiodon elongates*), Greenling (*Hexagrammidae*), Pacific cod (*Gadus macrocephelus,*), Sablefish (*Anoplopoma fimbria*), Sculpin(*Cottidae*), Copper rockfish (*Sebastes caurinus*), Greenstripe rockfish (*S. elongates*), Quillback rockfish (*S. maliger*), Yelloweye rockfish (*S. ruberrimus*), Pacific sanddab (*Citharichthys sordidus*), Arrowtooth flounder (*Atheresthes stomias*), Halibut (*Hippoglossus stenolepis*), Octopus (*Octopoda*), Starfish (*Osteroida*)

SET NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38
Spiny dogfish	101	31	227	132	102	90	84	2	2	126	126	158	113	113	103	175	185	120	119	92	127	61	239	143	82	7	96	13	57	43	37	99	84	75	93	17	166	104
Ratfish	..	5	..	4	3	..	..	25	24	..	2	..	1	..	..	..	..	..	..	..	..	5	..	..	4	..	..	..	..	..	..	..	1	3	9	6	..	1
Longnose skate	..	..	..	..	..	..	..	..	..	..	1	1	..	..	1	..	..	2	..	1	..	..	..	1	..	4	..	3	3	..	..	..	..	1	..	2	..	..
Unidentified skate species	..	..	..	6	1	3	1	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Big skate	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..
Cat shark	..	..	..	..	..	1	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Black skate	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Lingcod	..	1	..	..	..	..	..	6	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	5	..	..	..
Sablefish	..	..	..	..	..	1	2	..	..	..	..	..	..	2	1	..	..	1	1	2	..	..	..	..	..	..	..	9	..	1	..	..	..	..	..	..	..	..
Pacific cod	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	2	..	..	..
Greenlings	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Yelloweye rockfish	..	..	..	2	6	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	1	..	..	1	..	..	..	..	..	..	..	1	15	..	10	..	4
Quillback rockfish	4	1	..	..	..	..	..	12	14	..	..	..	..	..	..	..	..	..	..	..	..	..	2	..	1	..	..	..	..	..	..	..	..	1	7	..	..	..
Copper rockfish	..	11	..	..	..	..	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	6	..	..	..
Greenstripe rockfish	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Unidentified sculpin	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..
Pacific sanddab	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..
Arrowtooth flounder	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..
Halibut	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Starfish	..	40	..	..	3	..	..	25	24	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	37	..	..	..

SET NO.	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	Total
Spiny dogfish	104	94	26	78	189	140	120	133	146	116	229	168	109	71	62	92	110	84	132	164	63	84	11	57	153	150	181	134	129	97	230	87	47	85	58	119	111	27	124	8058
Ratfish	..	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	104
Longnose skate	..	..	..	1	..	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	2	..	..	..	1	5	..	34
Unidentified skate species	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	12
Big skate	..	..	1	..	..	1	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5
Cat shark	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4
Black skate	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1
Lingcod	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	20
Sablefish	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	..	..	1	..	1	..	..	..	..	25
Pacific cod	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	5
Greenlings	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1
Yelloweye rockfish	6	1	..	..	..	..	..	..	..	..	..	..	..	..	2	..	..	..	..	..	2	1	..	..	..	2	1	1	..	..	..	..	1	..	1	4	..	..	..	6	69
Quillback rockfish	4	..	6	..	1	..	..	..	1	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	1	..	..	..	1	..	..	..	..	58
Copper rockfish	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	21
Greenstripe rockfish	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	1	..	..	..	..	..	4
Unidentified sculpin	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1
Pacific sanddab	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1
Arrowtooth flounder	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1
Halibut	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1
Starfish	..	..	1	..	..	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	18	..	..	..	2	..	..	..	3	..	..	..	..	..	..	7	..	181

Table 2. Number of fish caught by species during the October 1989 spiny dogfish survey. Species include: Spiny dogfish (*Squalus acanthias*), Ratfish (*Hydrolagus colliei*), Skate(*Rajidae*), Longnose skate (*Raja rhina*), Big skate (*R. binoculata*), Black skate (*R. kincaidi*), Brown catshark (*Apristurus brunneus*), Pacific Hake (*Merluccius productus*), Lingcod (*Ophiodon elongates*), Greenling (*Hexagrammidae*), Pacific cod (*Gadus macrocephelus,*), Sablefish (*Anoplopoma fimbria*), Sculpin(*Cottidae*), Copper rockfish (*Sebastes caurinus*), Greenstripe rockfish (*S. elongates*), Quillback rockfish (*S. maliger*), Yelloweye rockfish (*S. ruberrimus*), Pacific sanddab (*Citharichthys sordidus*), Arrowtooth flounder (*Atheresthes stomias*), Halibut (*Hippoglossus stenolepis*), Octopus (*Octopoda*), Starfish (*Osteroida*)

SET NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38
Spiny dogfish	186	190	172	107	28	167	175	2	112	102	181	107	233	180	230	239	254	204	198	218	212	131	124	142	151	186	152	76	59	83	122	58	152	142	161	127	164	148
Ratfish	..	..	..	2	12	..	..	7	1	6	..	..	..	..	..	..	..	..	..	..	..	..	..	2	2	..	..	3	10	1	..	7	..	..	..	..	..	1
Longnose Skate	4	7	1	1	..	2	3	..	..	..	2	..	..	1	2	..	2	1	..	..	1	1	1	..	1	..	..	4	1	..	..	..	1	..	2	..	..	2
Big Skate	1	..	..	..	..	..	..	1	..	..	1	..	..	..	..	1	1	..	..	..	..	..	..	..	..	2	..	..	..	1	..	..	..	1	..	..	..	..	..
Cat Shark	..	..	..	..	..	..	..	..	..	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Sablefish	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Lingcod	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..
Pacific Hake	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	2	..	..	..	..	..	..
Pacific Cod	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	1
Yelloweye rockfish	..	..	2	..	4	8	1	..	..	..	..	..	..	..	..	..	..	..	..	1	2	..	..	4	..	..	2	..	..	5	..	..	6	4	4	..	10	5
Quillback rockfish	..	..	..	..	6	..	1	8	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4	..	1	..	..	8	1	..	7	10	..	1	..	..	..
Greenstripe rockfish	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Copper rockfish	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Arrowtooth flounder	..	..	..	1	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Starfish	..	33	1	..	11	..	..	20	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4	..	..	10	..	..	9	..	..	..	..	..	..
Octopus	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

SET NO.	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	Total
Spiny dogfish	106	157	175	107	79	188	106	179	129	85	143	178	111	228	175	164	182	134	205	238	96	230	160	131	11	148	240	133	192	216	20	10321
Ratfish	..	2	1	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	1	..	..	..	..	..	..	69
Longnose Skate	..	1	1	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	2	..	45
Big Skate	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	11
Cat Shark	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2
Sablefish	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	4
Lingcod	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4
Pacific Hake	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	3
Pacific Cod	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	3
Yelloweye rockfish	1	12	3	..	1	..	1	1	1	1	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	1	..	1	..	3	85
Quillback rockfish	..	..	1	..	5	..	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	2	..	..	..	1	63
Greenstripe rockfish	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1
Copper rockfish	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	1
Arrowtooth flounder	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2
Starfish	..	..	1	..	12	..	..	..	..	..	..	2	..	..	..	..	..	..	5	5	..	..	..	1	28	..	..	..	..	..	2	147
Octopus	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	2

Table 3. Cumulative length frequencies of all spiny dogfish caught during 1986 and 1989 Strait of Georgia longline surveys.

Length (cm)	1986			1989		
	Number of males	Number of females	Total	Number of males	Number of females	Total
19				1		
20				0		
21				0		
22				0		
23	1			0		
24	0			0		
25	1			1		
26	0			1		
27	0			0		
28	0			0		
29	0			1		
30	0			0	1	
31	0			0	0	
32	0			0	0	
33	0			0	0	
34	0			1	0	
35	0			0	0	
36	1		1	0	0	
37	0		0	0	0	
38	0		0	0	0	
39	0		0	0	0	
40	0		0	1	1	2
41	2		2	0	1	1
42	1		1	0	0	0
43	1		1	0	0	0
44	1		1	0	2	2
45	1		1	2	2	4
46	0		0	2	5	7
47	3	1	4	2	2	4
48	2	2	4	3	6	9
49	6	1	7	5	1	6
50	8	4	12	10	6	16
51	7	2	9	9	5	14
52	2	1	3	7	11	18
53	6	2	8	17	16	33
54	11	3	14	19	8	27
55	11	1	12	8	19	27
56	8	10	18	29	17	46
57	13	3	16	40	18	58
58	16	12	28	19	21	40
59	23	10	33	34	32	66
60	24	22	46	49	33	82

Table 3 continued.

Length (cm)	1986			1989		
	Number of males	Number of females	Total	Number of males	Number of females	Total
61	31	17	48	43	29	72
62	29	23	52	49	32	81
63	35	25	60	51	52	103
64	39	26	65	76	55	131
65	44	36	80	81	49	130
66	62	24	86	77	46	123
67	53	33	86	75	87	162
68	58	27	85	102	63	165
69	64	36	100	104	63	167
70	87	42	129	122	63	185
71	81	28	109	144	77	221
72	103	44	147	150	52	202
73	106	29	135	167	72	239
74	122	24	146	209	84	293
75	155	35	190	230	96	326
76	181	34	215	338	66	404
77	207	29	236	302	69	371
78	253	28	281	360	73	433
79	272	33	305	424	53	477
80	323	32	355	393	64	457
81	359	31	390	410	63	473
82	401	33	434	420	56	476
83	398	34	432	418	45	463
84	476	35	511	440	56	496
85	391	30	421	375	53	428
86	383	38	421	374	60	434
87	331	37	368	315	45	360
88	306	35	341	214	38	252
89	236	38	274	201	35	236
90	189	36	225	139	49	188
91	120	39	159	78	69	147
92	82	39	121	58	49	107
93	53	37	90	53	53	106
94	32	33	65	24	56	80
95	15	44	59	13	65	78
96	14	48	62	14	63	77
97	5	50	55	4	68	72
98	2	52	54	4	63	67
99	1	50	51		76	76
100	2	40	42		68	68

Table 3 continued.

Length (cm)	1986			1989		
	Number of males	Number of females	Total	Number of males	Number of females	Total
101	0	50	50		61	61
102	1	42	43		59	59
103	0	41	41		60	60
104	1	41	42		47	47
105		29	29		32	32
106		36	36		36	36
107		20	20		38	38
108		15	15		21	21
109		17	17		20	20
110		16	16		13	13
111		6	6		11	11
112		9	9		8	8
113		3	3		6	6
114		6	6		6	6
115		7	7		4	4
116		1	1		3	3
117		2	2		1	1
118		3	3			
119		2	2			
120		2	2			
Total:	6252	1806	8058	7312	3008	10320

Table 4. Summary of number of sets, mean effective fishing time, number of hooks deployed, number of spiny dogfish caught, CPUE (fish per 1000 hooks) and mean length by survey year and area from October 1986 and 1989 spiny dogfish longline surveys.

1986										
Area	Number of sets	Mean effective fishing time	Number of Hooks	Number of Dogfish	CPUE			Mean length (cm)		
					Males	Females	Total	Males	Females	Total
Active Pass	5	142	2485	525	181.9	29.4	211.3	84.9	97.7	86.7
Porlier Pass	5	148	2500	410	104.8	58	164	83.8	99.4	89.3
Sturgeon Bank	6	133	2985	815	248.9	23.7	272.6	82.6	72.9	81.8
Entrance Island	7	179	3500	740	140.3	71.1	211.4	80.9	92.7	84.8
Halibut Bank*	7	165	3500	802	173.1	55.4	229.1	83.3	88.4	84.3
French Creek	6	167	3000	253	62.7	21.7	84.3	73.6	76.6	74.4
Hornby Island	5	147	2500	368	118.4	28.8	147.2	78.8	85	80
Ajax-Exeter *	6	140	3000	572	165	25.6	190.6	79.3	88.3	80.5
Cape Lazo	6	145	2995	844	263.1	18.7	281.8	80.9	68.9	80.1
Oyster River	4	148	1995	418	194.5	15	209.5	79.2	65.3	78.2
Cape Mudge	5	139	1750	639	310.3	54.9	365.1	78.8	70.8	77.6
Grants Reef	5	147	2500	691	242.8	33.6	276.4	80.9	75.9	80.3
Sinclair Bank	6	152	3000	532	67	110.3	177.3	74.1	83.5	79.9
Epson Point	4	142	2000	449	93	131.5	224.5	80.9	89.2	85.7
Total	77	146	37,710	8,058	165.7	47.9	213.7	80.5	85.5	81.9

1989										
Area	Number ofsets	Mean effective fishing time	Number of Hooks	Number of Dogfish	CPUE			Mean length (cm)		
					Males	Females	Total	Males	Females	Total
Active Pass	5	148	2500	504	166.4	35.2	201.6	83	93.2	84.8
Porlier Pass	4	149	2001	477	168.9	69.4	238.4	81.8	95.4	85.8
Sturgeon Bank	5	147	2502	1136	389.7	64.4	454.2	81.1	72.6	79.9
Entrance Island	5	133	2501	784	143.9	169.5	313.5	79.5	92.7	86.7
Halibut Bank*	5	147	2500	962	267.2	117.6	384.8	79.9	80.5	80.1
French Creek	5	133	2500	755	202	100	302	73.6	73.4	73.6
Hornby Island	5	145	2500	398	112	46	159.2	78.3	82.1	78.8
Ajax-Exeter	6	143	2999	894	257.4	40.3	297.7	78.3	82.1	78.8
Cape Lazo	5	146	2500	854	311.6	29.6	341.2	80.5	68.9	79.5
Oyster River	5	140	2500	860	316.8	27.2	344	80.4	64.5	79.2
Cape Mudge	4	136	1900	660	256.3	91.1	347.4	72.8	66.8	71.2
Grants Reef	5	196	2500	624	178.8	70.8	249.6	79.1	80.4	79.4
Sinclair Bank	5	131	2317	687	91.9	204.6	296.5	71.9	79.7	77.3
Epson Point	5	143	2500	724	110	179.6	289.6	79.3	89.5	85.7
Total	69	146	34,221	10,319	212	87.8	301.4	79	82.5	80

*Includes 2 sets that spanned two depth intervals

Table 5. Summary of CPUE (fish per 1000 hooks), mean effective fishing time (minutes), mean total length (cm) by depth stratum from the October 1986 and 1989 spiny dogfish longline surveys.

1986											
						CPUE			Mean length		
Depth stratum	Depth range	Number of sets	Mean effective fishing time	Number of hooks	Number of dogfish	Male	Female	Total	Male	Female	Total
1	0 - 55	15	147	7500	1463	134.5	60.3	195.1	81.3	91.4	84.4
2	56 -110	20	149	9740	2149	155	64.7	220.6	79.9	86.9	82.1
3	111 -165	15	154	7500	1700	188.6	38	226.7	80.5	83.5	81.1
4	166 -220	14	149	6735	1608	192	46.8	238.8	81	79.7	80.8
5	>221	11	134	5235	976	165.8	20.6	186.4	81.4	74.9	80.7
Total*		75		36,710	7,896						

1989											
						CPUE			Mean length		
Depth stratum	Depth range	Number of sets	Mean effective fishing time	Number of hooks	Number of dogfish	Male	Female	Total	Male	Female	Total
1	0 - 55	14	149	6717	1807	166.6	102.4	195.1	77.5	87.3	81.2
2	56 -110	14	145	7003	2110	188.3	112.7	301	79.4	87.5	82.4
3	111 -165	14	144	7000	2219	230.6	86.3	316.9	78.8	80.8	79.3
4	166 -220	15	142	7500	2355	241.2	72.8	314	79	75.9	78.3
5	>221	10	149	5000	1416	227.8	55.4	283.2	79.5	71.1	77.9
Total*		67		33,220	9,907						

*Excludes two sets that spanned two depth intervals

Table 6. Summary (mean, minimum, maximum) of total length (cm) data for spiny dogfish captured by depth stratum.

1986*

Depth Stratum	Male spiny dogfish			Female spiny dogfish			All spiny dogfish		
	mean	min	max	mean	min	max	mean	min	max
1	81.5	47.3	102.2	91.4	58.3	119.4	84.5	47.3	119.4
2	79.9	48.9	103.6	86.8	52.9	120.2	82.1	48.9	120.2
3	80.4	43.1	101.7	82.3	50	117.8	80.8	43.1	117.8
4	81.2	23.1	100.4	80.5	46.6	115.5	81.1	23.1	115.5
5	81.2	35.8	96.7	75.3	48.2	108.9	80.5	35.8	108.9

1989*

Depth Stratum	Male spiny dogfish			Female spiny dogfish			All spiny dogfish		
	mean	min	max	mean	min	max	mean	min	max
1	77.5	49.2	98.4	87.1	52.6	117.3	81.2	49.2	117.3
2	79	29.2	97.5	83.8	29.9	115.9	80.5	29.2	115.9
3	78.8	25.7	96.8	81.1	43.6	116.2	79.4	25.7	116.2
4	79	19	98.4	76.4	41.2	111.8	78.3	19	111.8
5	79.6	39.8	96.6	81.6	40.4	119.9	80.2	39.8	119.9

* Does not include sets that spanned two depth intervals.

Table 7. Mean length by sex and observed maturity stages of all spiny dogfish sampled in October 1986 and 1989.

MALES									
1986					1989				
Maturity Code	Count	Mean length (cm)	Minimum length (cm)	Maximum length (cm)	Maturity Code	Count	Mean length (cm)	Minimum length (cm)	Maximum length (cm)
I	518	63.3	35.8	84.1	I	826	62.9	39.8	79.3
I2	271	71.1	62.3	79.7	I2	434	71.4	51.4	83.2
R	5460	82.9	57	103.6	R6	45	81.6	54.1	98.4
FEMALES									
I	490	67.5	46.6	46.6- 87.8	I	1563	70.5	40.4	92.8
R1D1	337	79.9	62.4	62.4- 96.8	R1D1	17	80.6	61.8	89.1
R1D2	43	87.7	77.2	77.2-106.0	R1D2	213	84.3	67.8	102.8
R1D3	3	86.1	81.4	81.4- 90.7	R1D3	45	87.4	77.3	103.2
R1D4	1	84.4			R1D4	2	98.9	96.3	101.5
R1D8	31	95.3	76.2	76.2-105.9	R1D8	57	96	84.4	109.9
R2D1	3	82.6	75.4	75.4- 87.5					
R2D2	135	89.6	77.2	77.2-100.4	R2D2	30	83.8	70.7	102.4
R2D3	68	95	83.7	83.7-107.0	R2D3	90	88.9	77	102.2
R2D4	21	95.4	82.4	82.4-112.0	R2D4	50	93.8	83.1	104.3
R2D6	247	100.1	80.9	80.9-119.7	R2D6	599	99.4	81.8	117.3
R2D7	2	88.3	87	87.0- 89.5					
R2D8	3	99.3	89.5	89.5-108.0	R2D8	3	96.2	84.6	105.1
					R3D4	5	86.7	79.9	97.5
R3D6	377	100.8	80.4	80.4-120.2	R3D6	317	100	85.6	114.1
R3D8	32	93.6	80.3	80.3-105.5	R3D8	16	95.3	83.2	109
Both sex									
40	3	87.5		85.0- 89.1	40	3	79.6	79.1	80.1

Table 8. Mean size (total length in cm) of mature female spiny dogfish with pups and mean number of large eggs per female during the 1986 and 1989 spiny dogfish longline surveys.

Year	Number sampled	Mean total length (cm)	Minimum total length (cm) of female with pups	Maximum total length (cm) of female with pups	Mean number of eggs per female	Minimum number of eggs per female	Maximum number of eggs per female
1986	396	100.2	80.3	120.2	7.2	2	16
1989	341	99.5	79.9	114.1	7.6	3	16

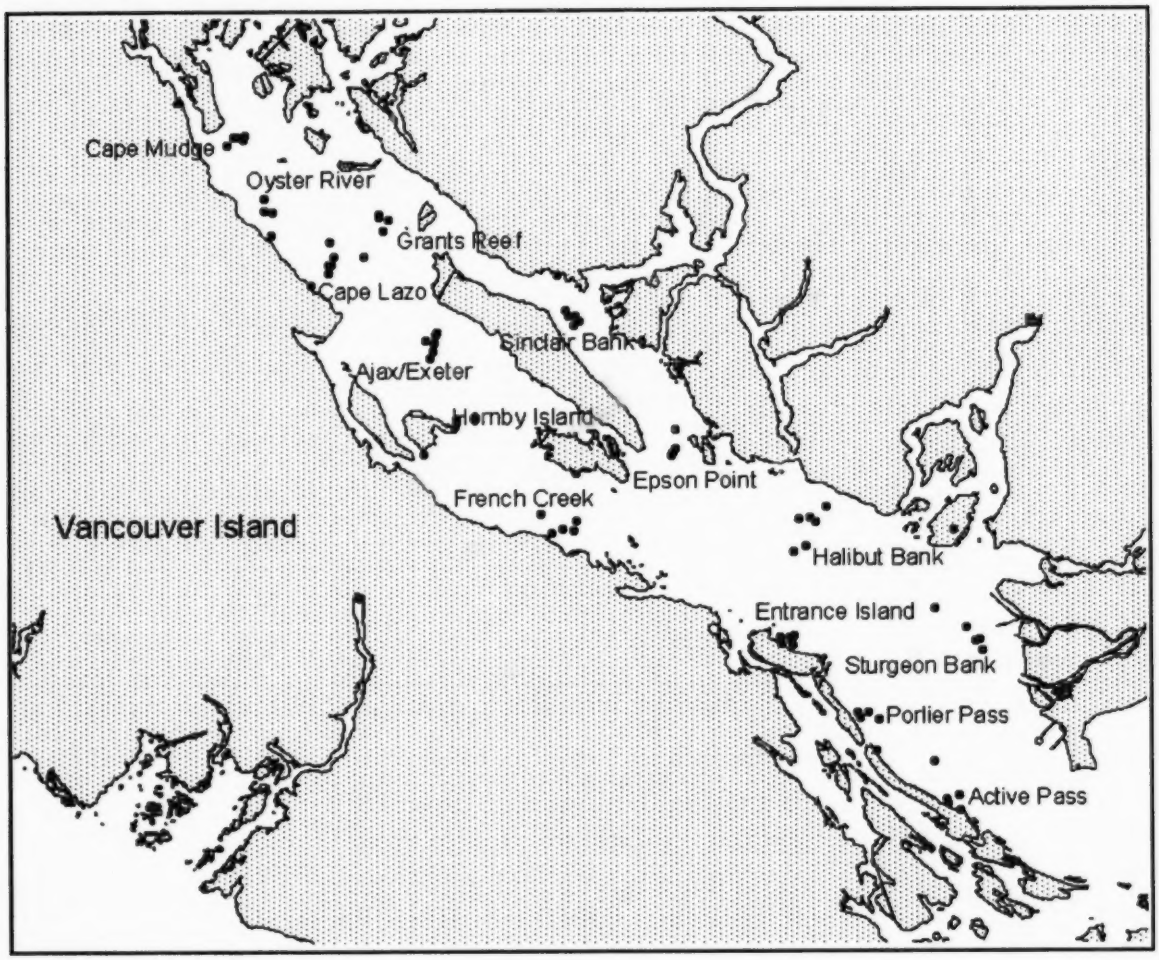


Figure 1. Set locations from the Strait of Georgia spiny dogfish hook and line survey conducted from October 10-26, 1986.

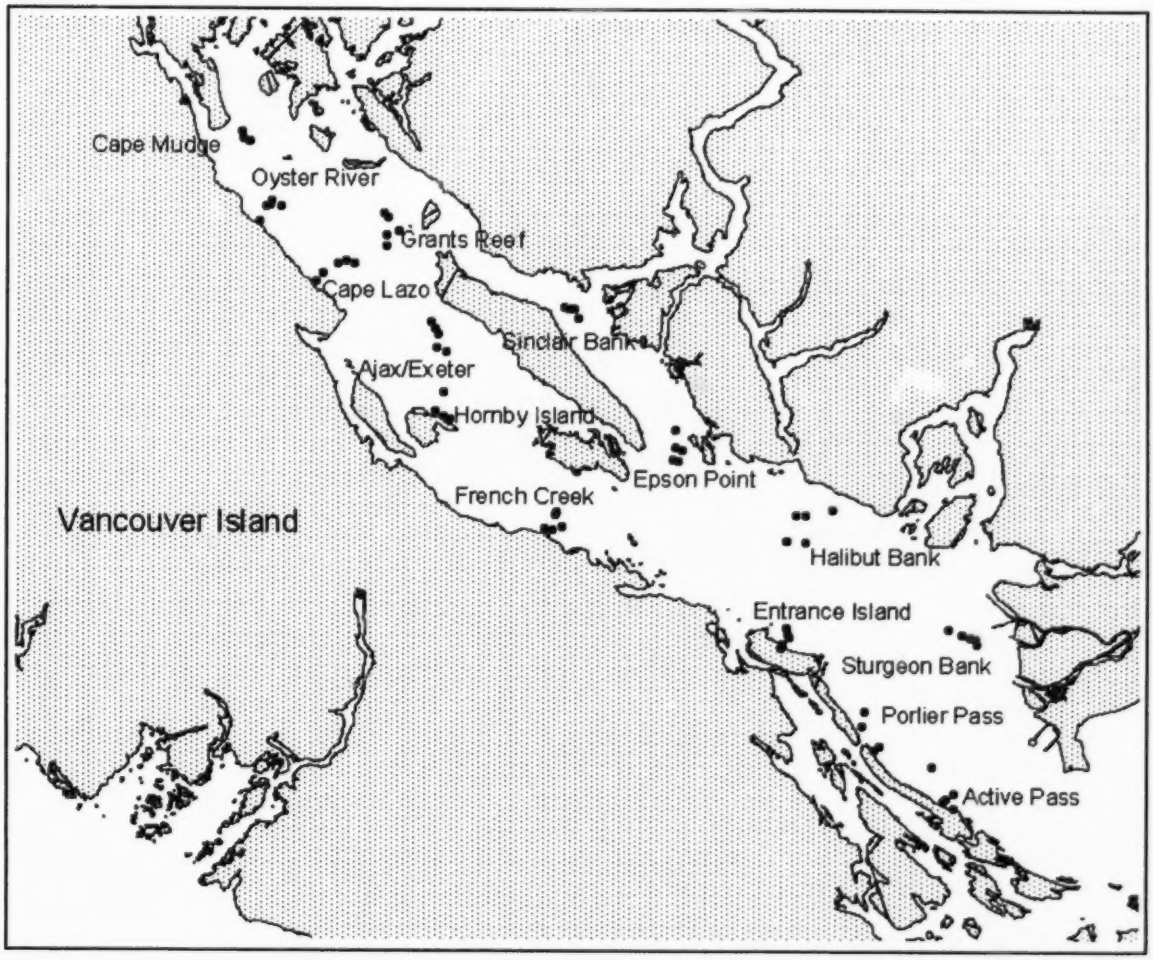


Figure 2. Set locations from the Strait of Georgia spiny dogfish hook and line survey conducted from October 15-30, 1989.

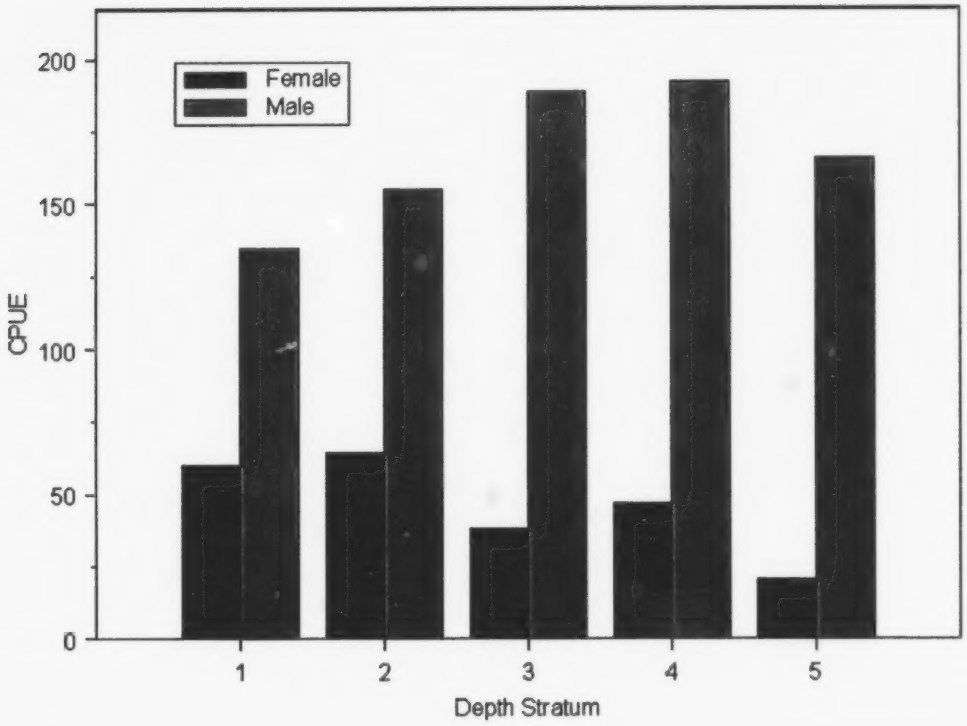


Figure 3. Spiny dogfish catch per unit effort (CPUE, fish per thousand hooks) by depth stratum (1: 0 to 55m, 2: 56 to 110m, 3: 111 to 165m, 4: 166 to 220m and 5: deeper than 220m) from the Strait of Georgia spiny dogfish hook and line survey conducted October 10-26, 1986.

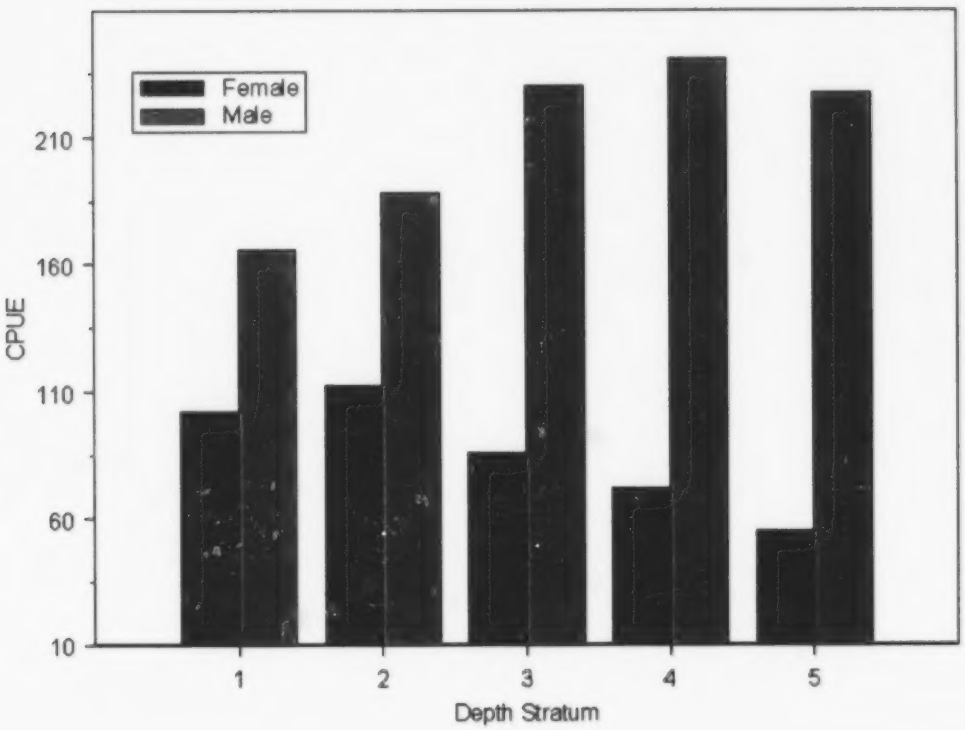
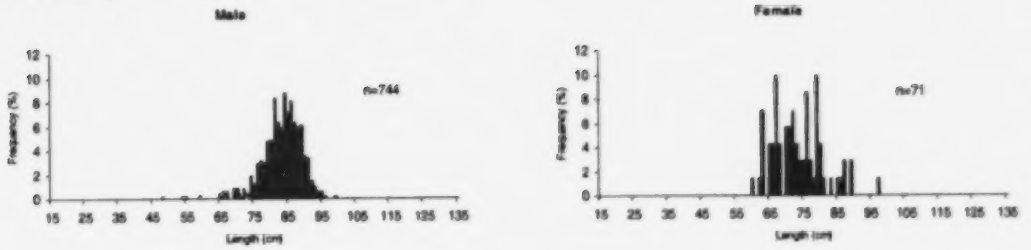
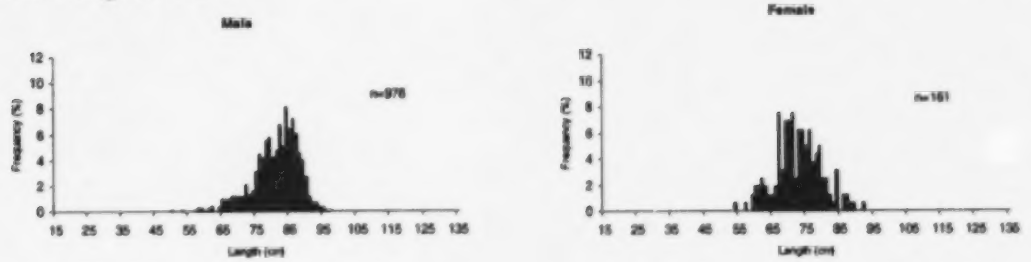


Figure 4. Spiny dogfish catch per unit effort (CPUE, fish per thousand hooks) by depth stratum (1: 0 to 55m, 2: 56 to 110m, 3: 111 to 165m, 4: 166 to 220m and 5: deeper than 220m) from the Strait of Georgia spiny dogfish hook and line survey conducted from October 15-30, 1989.

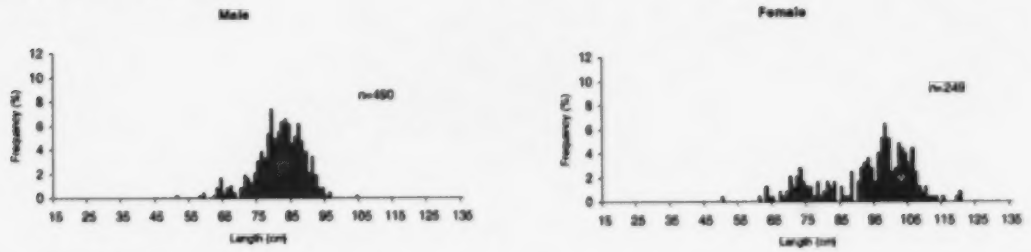
1986 Sturgeon Bank



1989 Sturgeon Bank



1986 Entrance Island



1989 Entrance Island

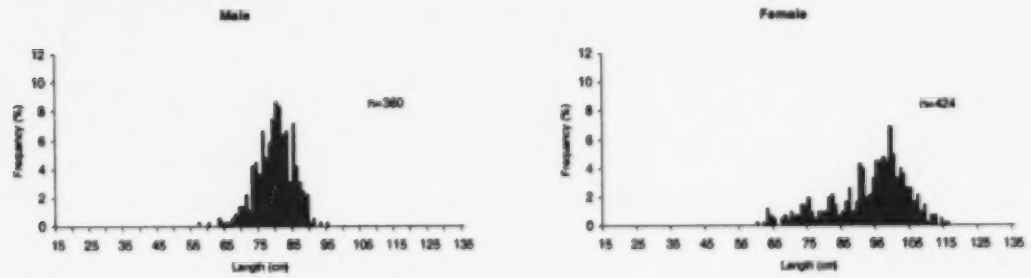
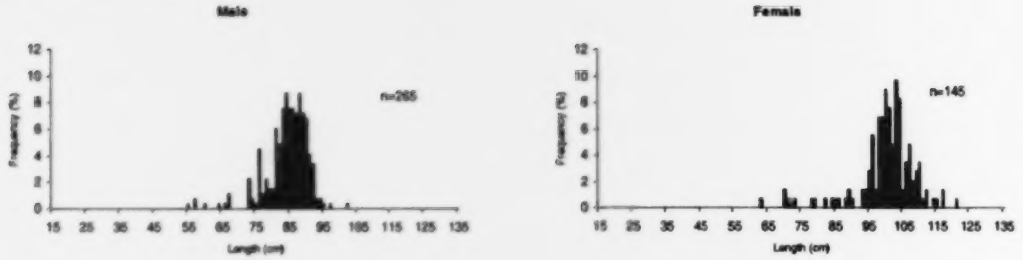
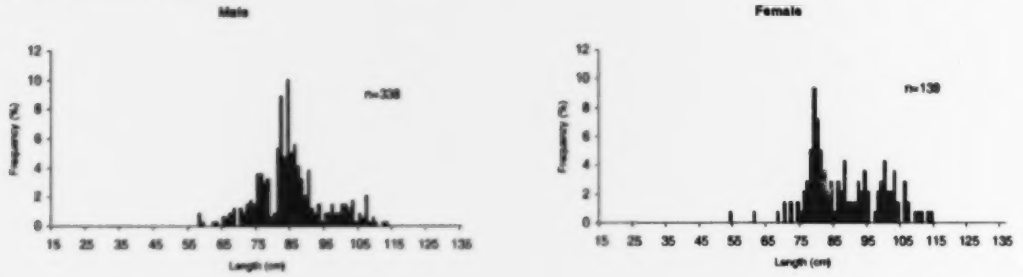


Figure 5. Spiny dogfish length frequency by year and area for longline surveys conducted in the Strait of Georgia in October, 1986 and 1989.

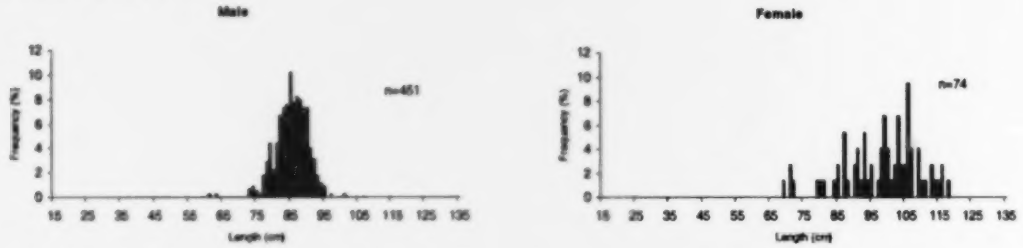
1986 Porlier Pass



1989 Porlier Pass



1986 Active Pass



1989 Active Pass

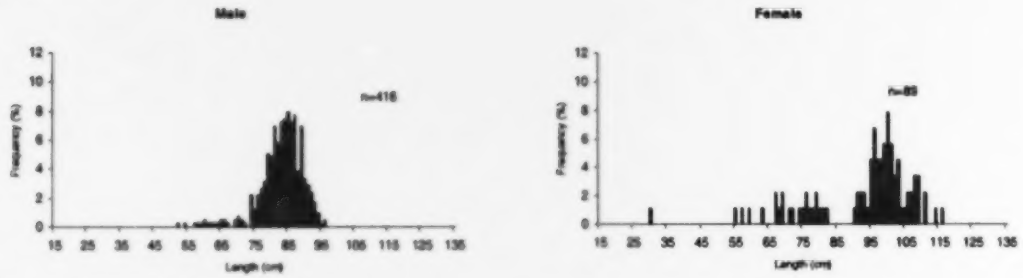
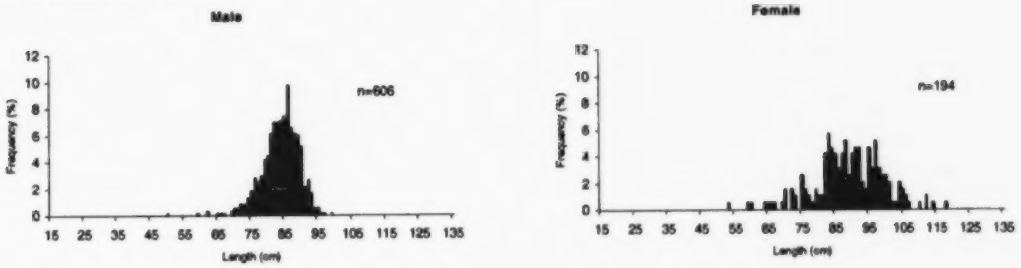
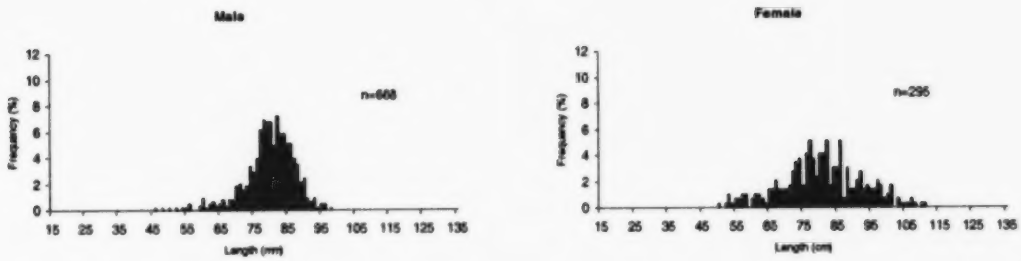


Figure 5 continued.

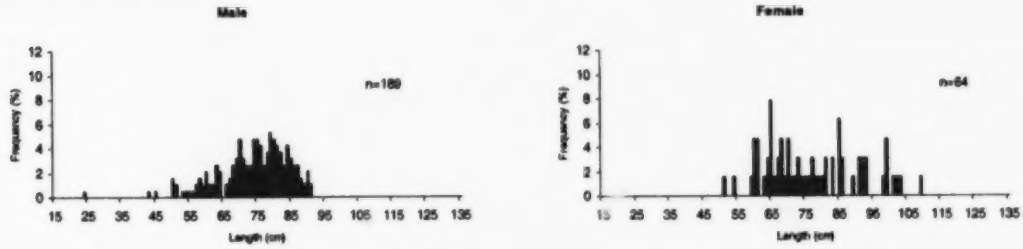
1986 Halibut Bank



1989 Halibut Bank



1986 French Creek



1989 French Creek

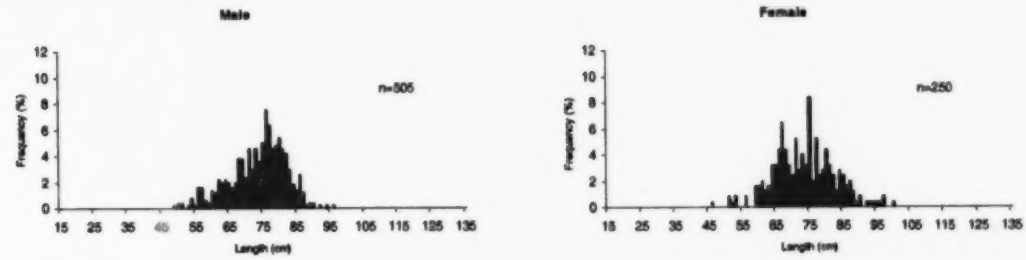
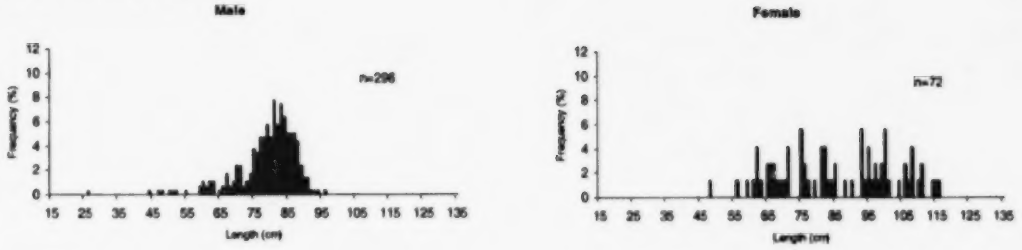
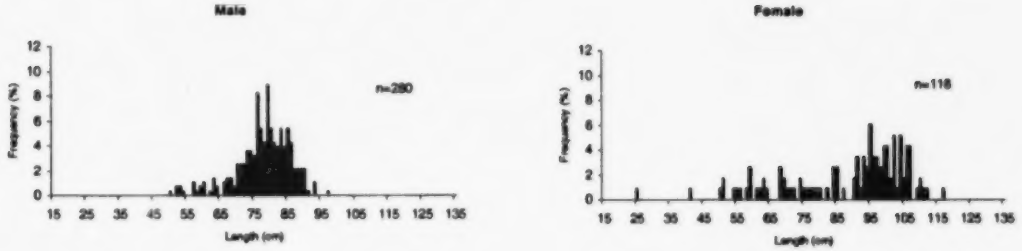


Figure 5 continued.

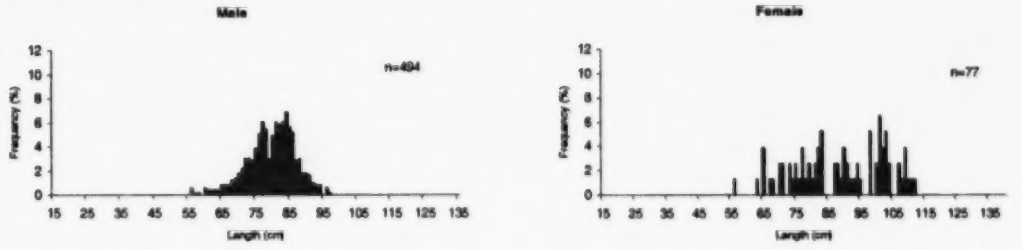
1986 Hornby Island



1989 Hornby Island



1986 Ajax Exeter



1989 Ajax Exeter

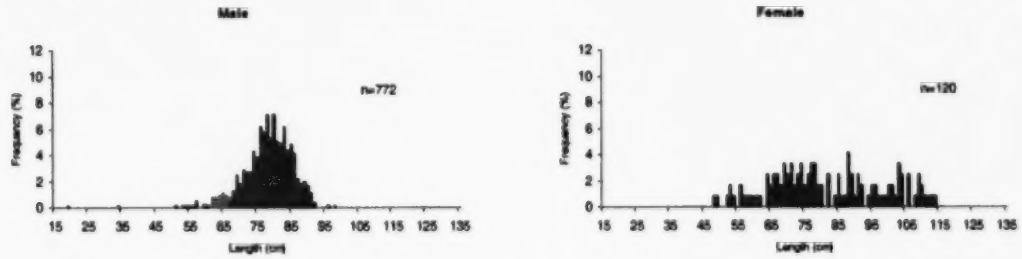
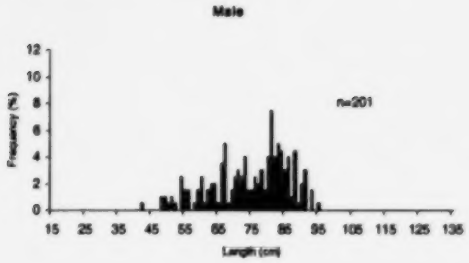
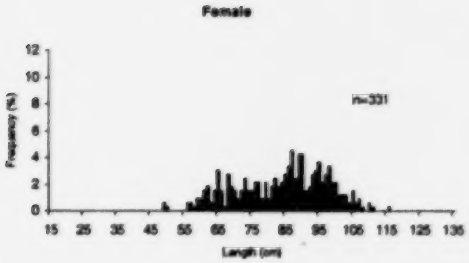


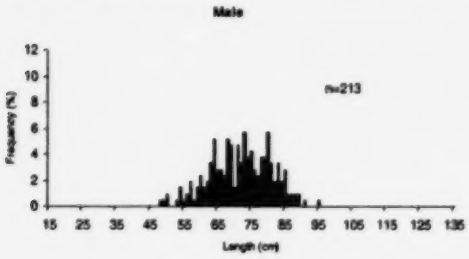
Figure 5 continued.

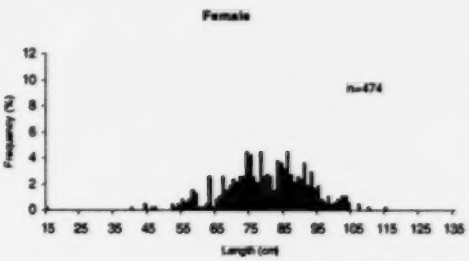
1986 Sinclair Bank



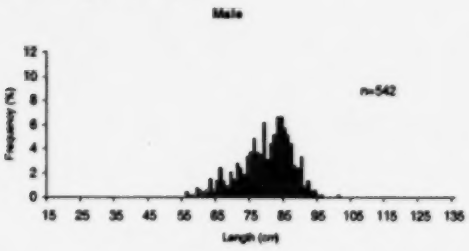


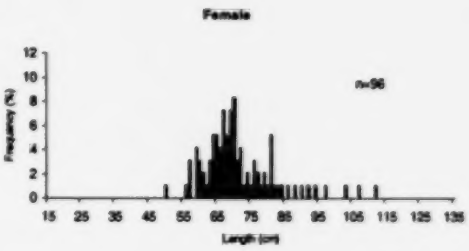
1989 Sinclair Bank



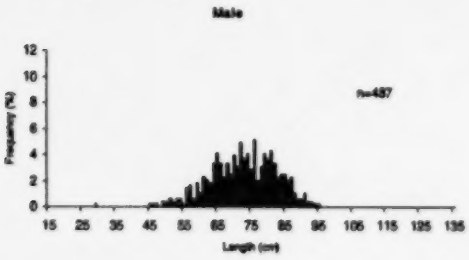


1986 Cape Mudge





1989 Cape Mudge



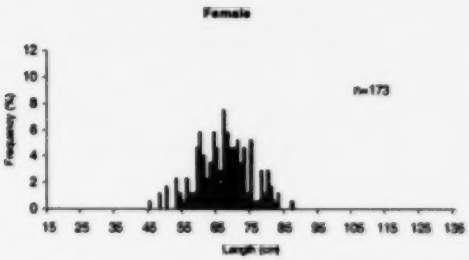
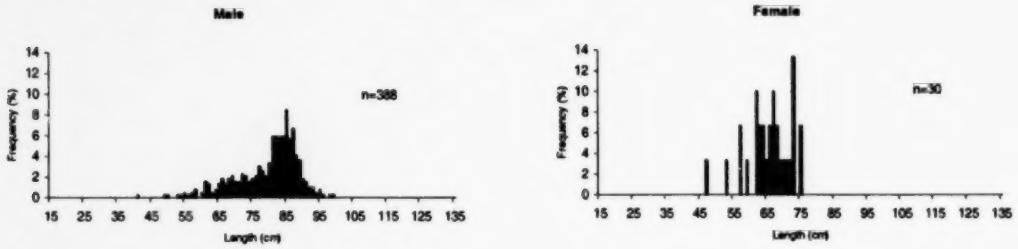
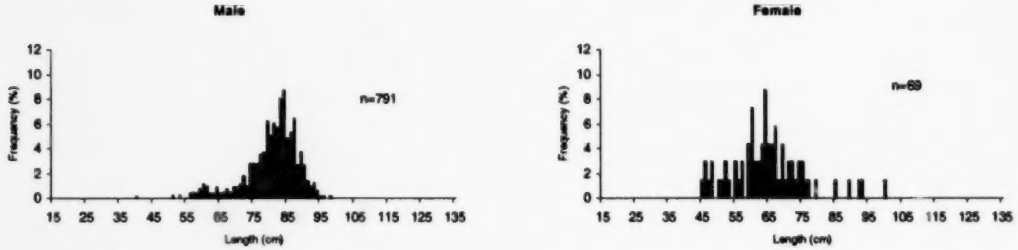


Figure 5 continued.

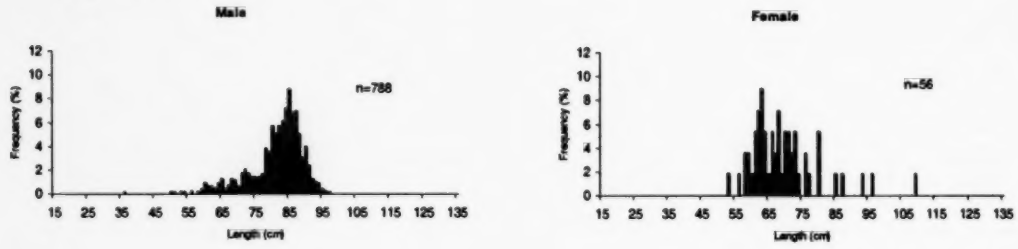
1986 Oyster River



1989 Oyster River



1986 Cape Lazo



1989 Cape Lazo

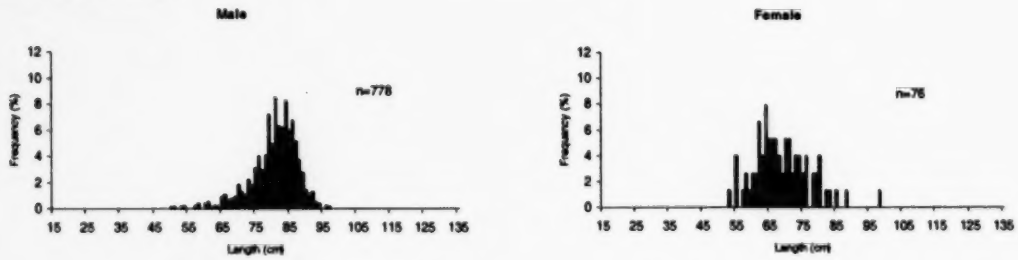
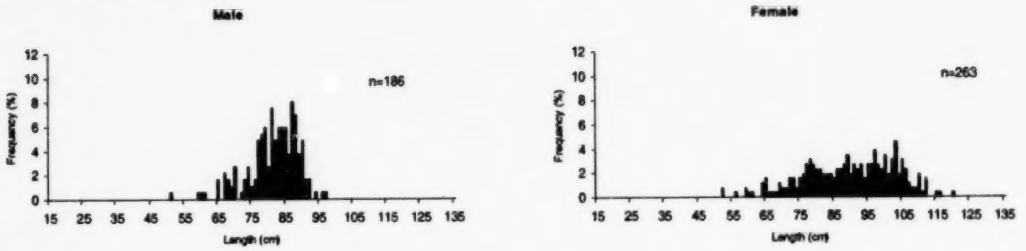
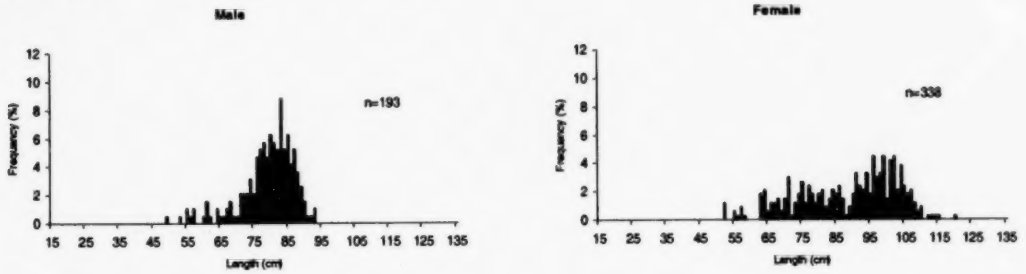


Figure 5 continued.

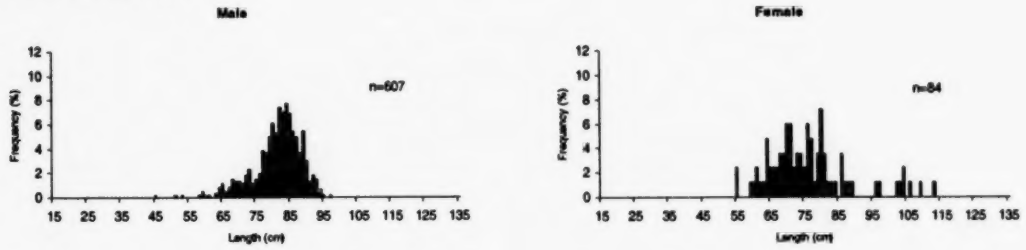
1986 Epson Point



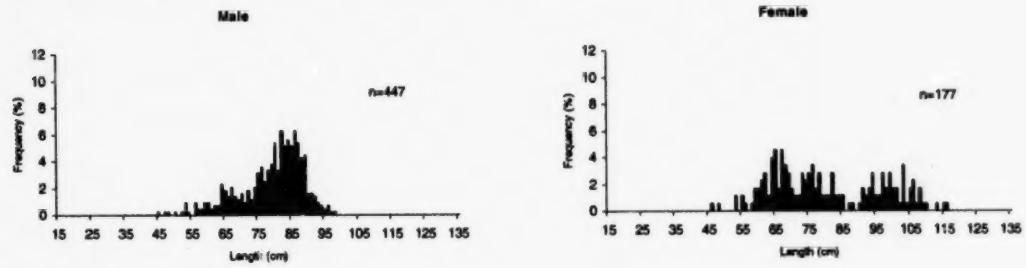
1989 Epson Point



1986 Grants Reef



1989 Grants Reef



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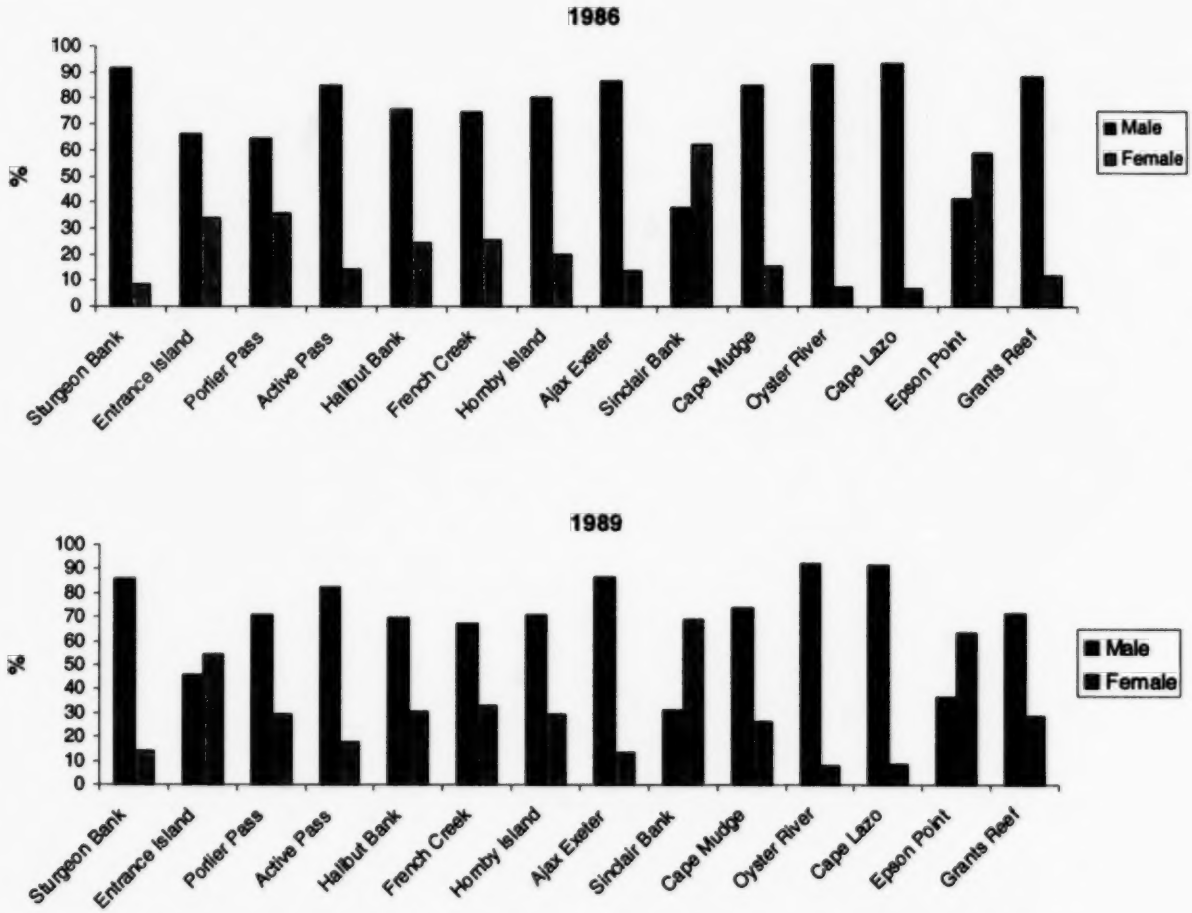

Figure 6. Spiny dogfish sex ratio by year and site from samples taken in the Strait of Georgia, October of 1986 and 1989.

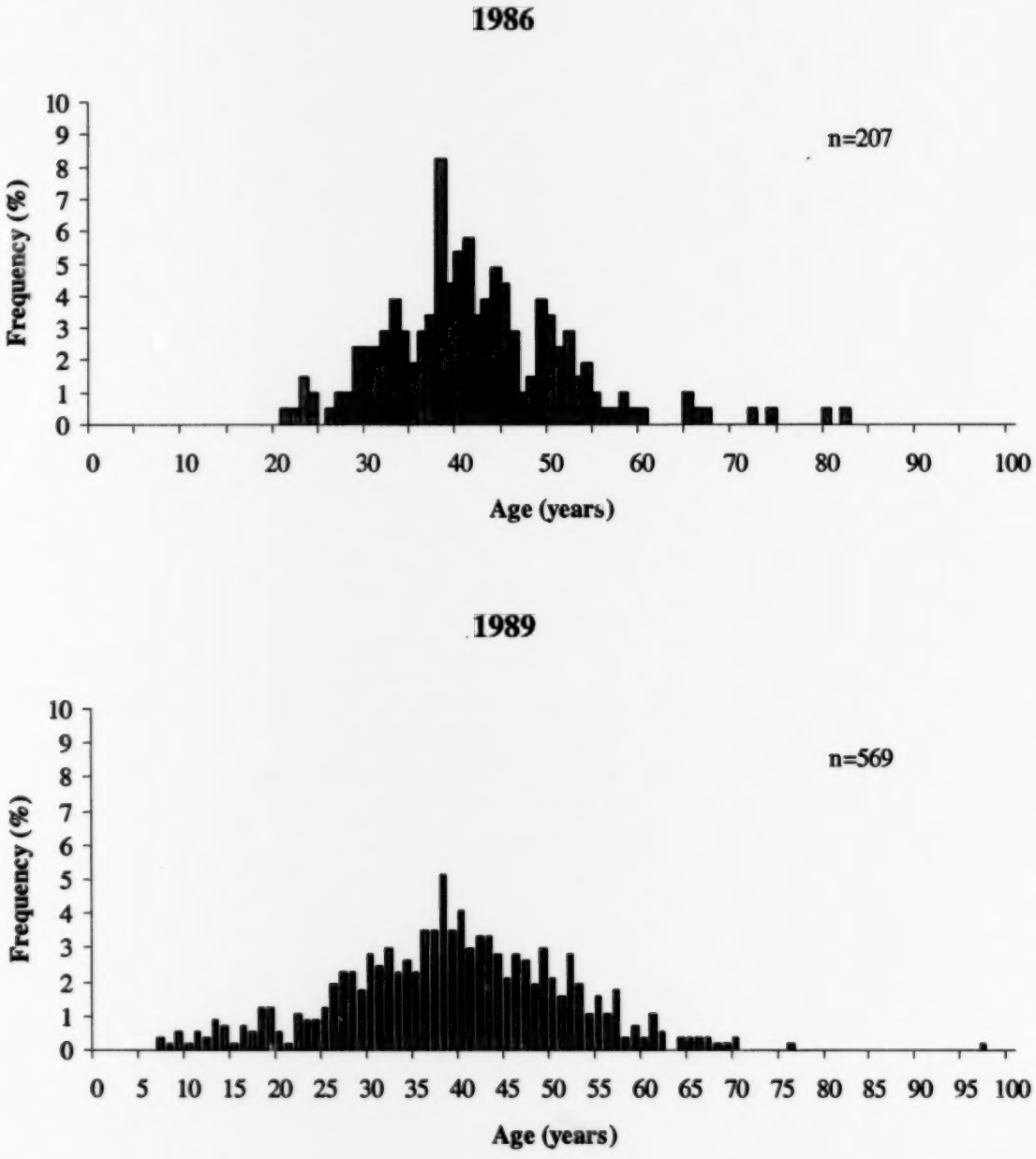

Figure 7. Age composition estimated of female spiny dogfish sampled at Porlier Pass and Halibut Bank in October of 1986 and Entrance Island, Hornby Island, Ajax Exeter, Grants Reef, Sinclair Bank, Cape Mudge, Oyster River, Cape Lazo and Epson Point in 1989.

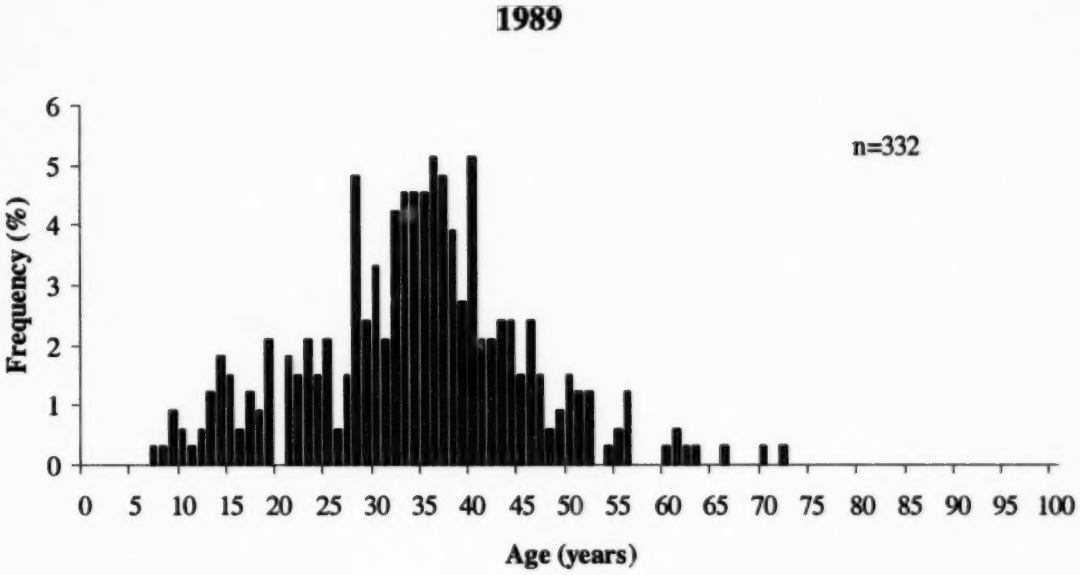

Figure 8. Age composition estimated of male spiny dogfish sampled at Entrance Island, Hornby Island, Ajax Exeter, Grants Reef, Sinclair Bank, Cape Mudge, Oyster River, Cape Lazo and Epson Point in 1989.

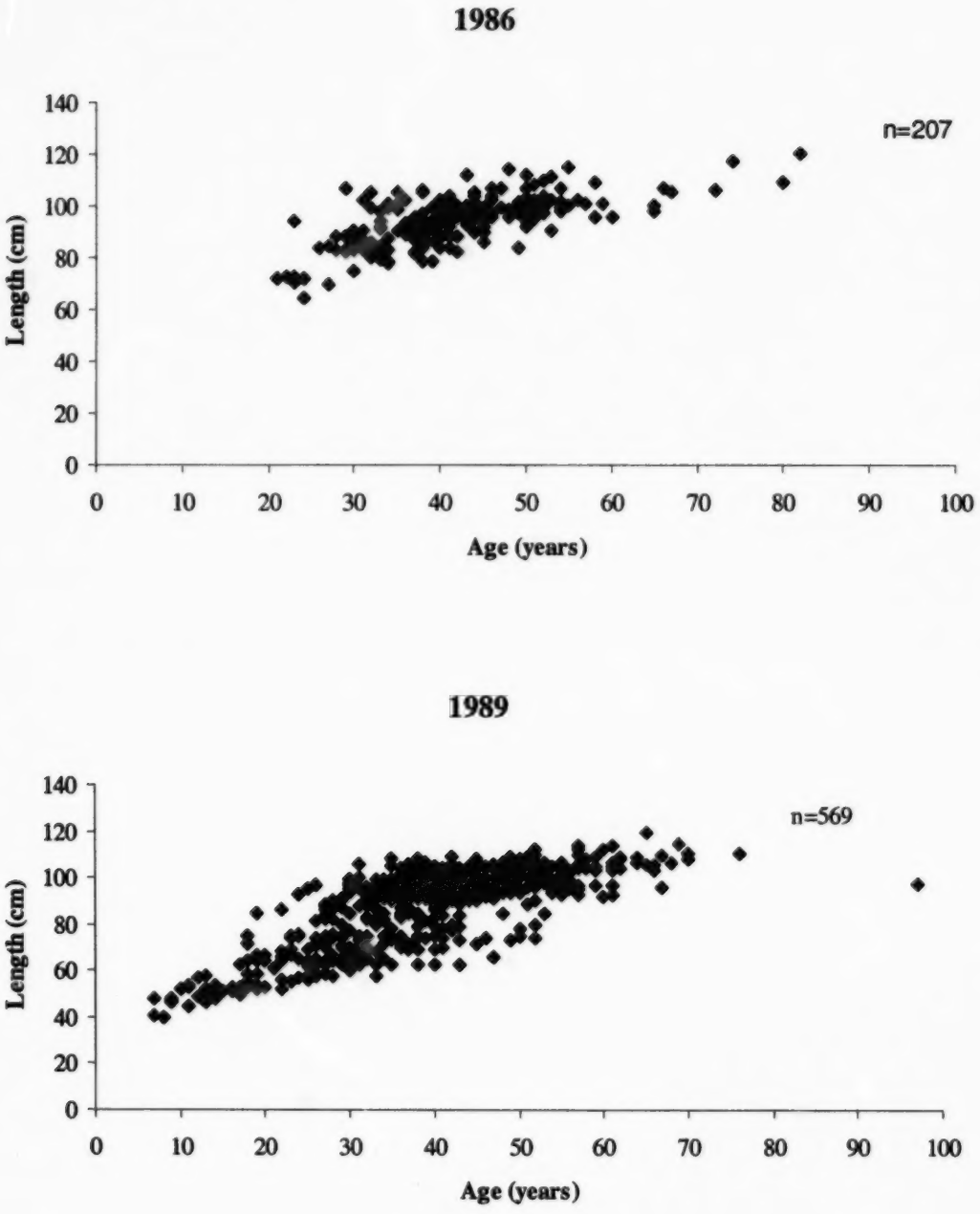

Figure 9. Length at age for female spiny dogfish sampled at Porlier Pass and Halibut Bank in October of 1986 and Entrance Island, Hornby Island, Ajax Exeter, Grants Reef, Sinclair Bank, Cape Mudge, Oyster River, Cape Lazo and Epson Point in 1989.

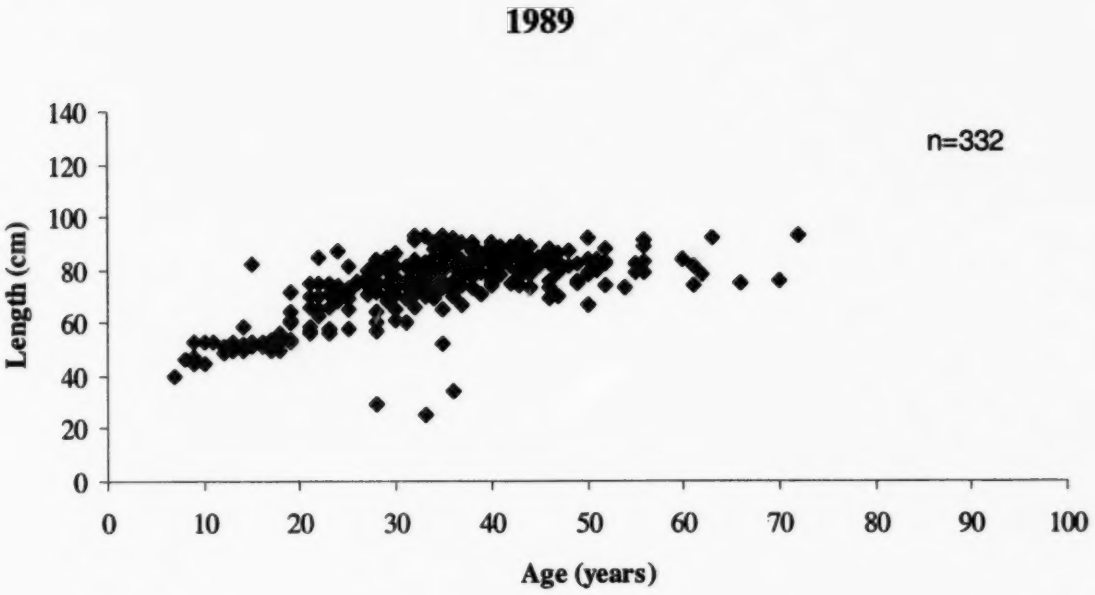

Figure 10. Length at age for male spiny dogfish sampled at Entrance Island, Hornby Island, Ajax Exeter, Grants Reef, Sinclair Bank, Cape Mudge, Oyster River, Cape Lazo and Epson Point in October, 1989.

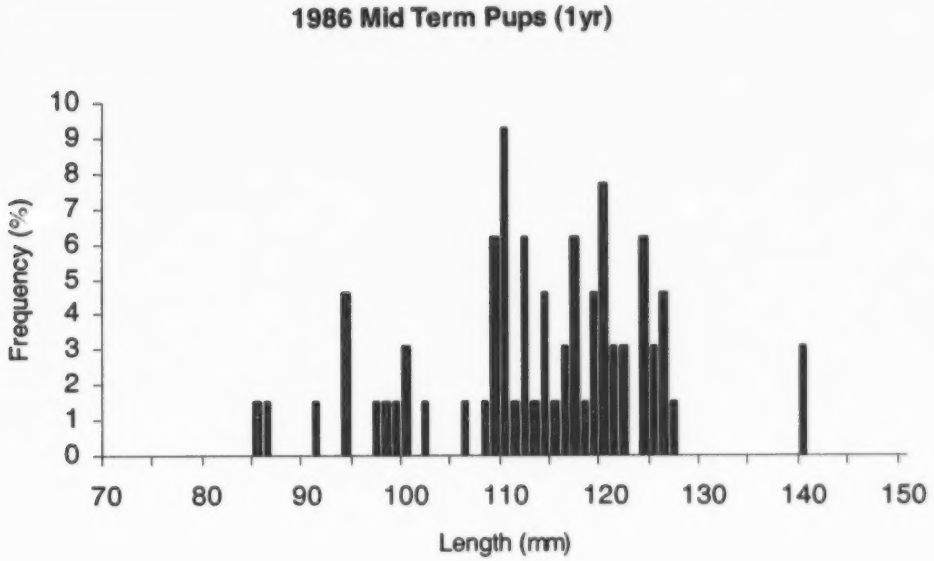

Figure 11. Spiny dogfish in utero pup measurements corresponding to a mid term pup (Ketchen 1976) from October, 1986.

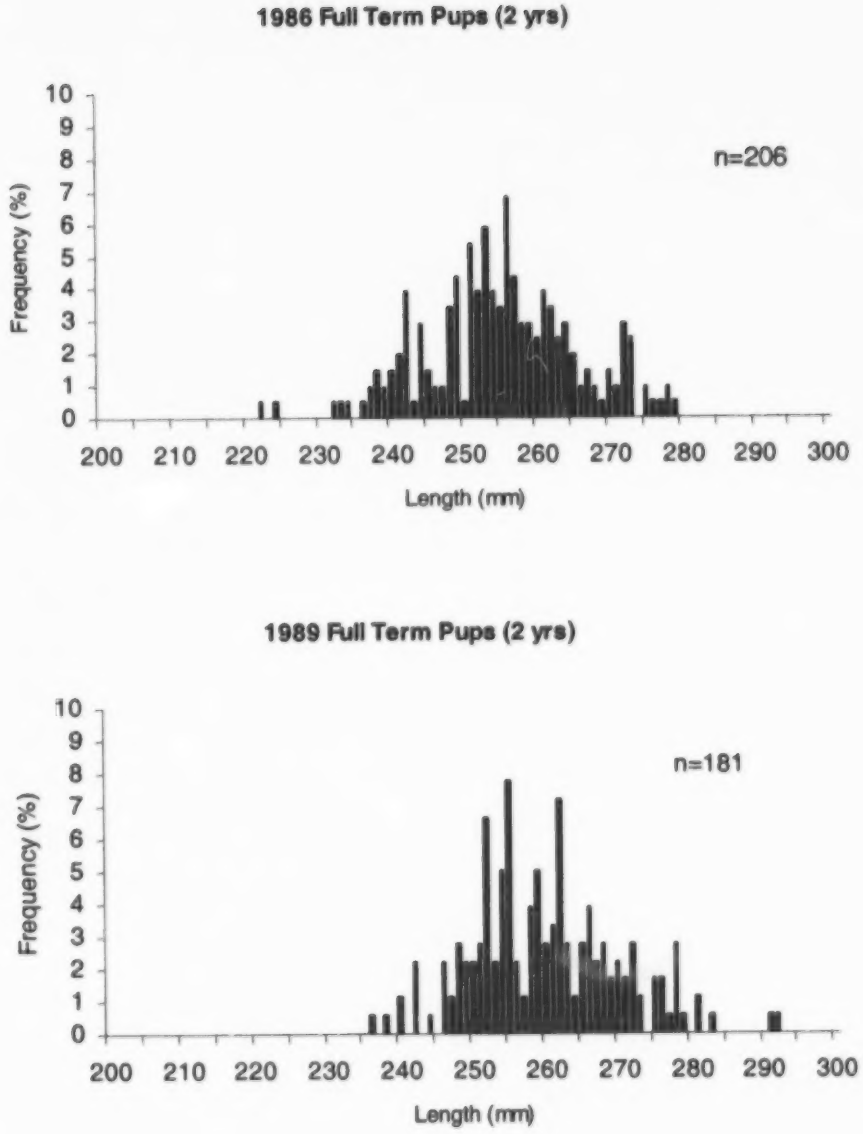

Figure 12. Spiny dogfish in utero pup measurements corresponding to a full term pup (Ketchen 1976) from the October, 1986 and 1989.

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Appendix 1. Description of the longline fishing gear used during dogfish longline surveys in the Strait of Georgia during 1986 and 1989.

Groundlines - #28 (6.5mm dia) 3 strand treated nylon (black), 1098m in length marked every 2m with paint; this line had sufficient length to incorporate 500 hooks. During fishing operations at each site 2 of these lines were in used.

Snaps - Model 72, made from 3.2mm stainless steel wire when attached to the groundline prevented the hooks from sliding along the groundline. The snaps were 3cm wide and 13cm long.

Gangions - #72 two ply braided nylon gangion twine (white) with loops at each end to permit attachment of a hook and a snap at each loop respectively. These loops were tied to allow an approximate spacing of 30cm from the eye of hook to the base of the snap.

Hooks - #12/0 stainless steel hooks complete with barbs, these hooks were made from 3.1mm stainless wire, the dimensions of these hooks were 3.1cm gape, 9.5cm from top eye to base and 3.6cm from tip to base. These hooks had a "J" configuration.

Bait - individually frozen large herring thawed or partially thawed usually cut into 4 pieces. Each piece was impaled twice on a hook. (double baited). (During fishing operations at least 1000 complete baited hooks, gangions and snaps were in use).

Buoy - Inflatable plastic bladders approximately 50-60cm in diameter used to suspend the buoyline.

Flagpole - attached to buoy, marked ends of set or string.

Buoyline - line similar to groundline, attached to buoy at the surface and was long enough to reach bottom where it was attached to the groundline. This line retrieved the anchor and groundline.

Anchor - approximately 12kg halibut style (Admiralty pattern) attached to fishing gear at juncture of groundline and buoyline. The anchor holds the set to the bottom and prevents the gear from drifting.

Line reel - stored, released, and retrieved groundlines and buoylines.

Appendix 2. Description of maturity codes used during the spiny dogfish longline surveys in October 1986 and 1989.

Male

Maturity Code	Condition	Description	Maturity Stage
10	I-1	Claspers do not extend past tips of anal fins; testes flat creamy.	Immature
30	I-2	Claspers extend past tips of anal fins; not stiff; testes, even creamy coulour, not brown	Maturing
90	R	Claspers extend past tips of anal fins; stiff; testes, cramy-brown, bloodshot, very firm	Mature

Female

Maturity Code	Ovaries		Uterii	Maturity Stage
10	I-1 Ova small, 0-5 mm diameter white firm ovary<1/4 length of body cavity.	D-1	Thin no thickening	Immature
50	R-1 Ova 5-10mm, white firm, ovary flaccid, flocculent external surface.	D-1	Thin no thickening	Immature
51	R-1 Ova 5-10mm, white firm, ovary flaccid, flocculent external surface.	D-2	Thin, <5mm thickened section, <1/4 length of body cavity	Immature
53	R-1 Ova 5-10mm, white firm, ovary flaccid, flocculent external surface.	D-3	About 5mm thickened section < 1/4 length of body cavity	Immature
55	R-1 Ova 5-10mm, white firm, ovary flaccid, flocculent external surface.	D-4	Thickened section at least 10mm or wider, flaccid; >1/3 length of body cavity	Maturing
56	R-1 Ova 5-10mm, white firm, ovary flaccid, flocculent external surface.	D-5	Encapsulated uterine eggs (candles)	Maturing
70	R-2 Ova yellow firm <30mm	D-1	Thin no thickening diameter	Maturing
71	R-2 Ova yellow firm <30mm	D-2	Thin, <5mm thickened section, <1/4 length of body cavity	Maturing
73	R-2 Ova yellow firm <30mm	D-3	About 5mm thickened section < 1/4 length of body cavity	Maturing
75	R-2 Ova yellow firm <30mm	D-4	Thickened section at least 10mm or wider, flaccid 1/3 length of body cavity	Maturing
77	R-2 Ova yellow firm <30mm	D-6	Yolk sac pups	Mature
78	R-2 Ova yellow firm <30mm	D-7	Term pups (no yolk sac)	Mature
79	R-2 Ova yellow firm <30mm	D-8	Flaccid	Mature
95	R-3 Ova white firm <10mm in diameter and yellow firm > 30mmin diameter; ovary flacid 1/3 length of body cavity	D-4	Thickened section at least 10mm or wider, flaccid; >1/3 length of body cavity	Mature
97	R-4 Ova white firm <10mm in diameter and yellow firm > 30mmin diameter; ovary flacid 1/3 length of body cavity	D-6	Yolk sac pups	Mature
99	R-5 Ova white firm <10mm in diameter and yellow firm > 30mmin diameter; ovary flacid 1/3 length of body cavity	D-8	Flaccid and empty	Mature

Appendix 3. Bridge log from the October 10-26, 1986 spiny dogfish longline survey. Effective fishing time in hours; all depths in meters; latitude and longitude in degrees, minutes and seconds.

Set	Date	Area	Start Time	Effective Fishing time	Start Latitude	Start Longitude	End Latitude	End Longitude	Depth Stratum	Start Depth	End Depth	Number of Hooks
1	15-Oct-86	Entrance Island	11:38	2.4	491100	1234724	491112	1234724	2	54	70	500
2	15-Oct-86	Entrance Island	12:55	3	491036	1234706	491106	1234736	1	9	18	500
3	15-Oct-86	Entrance Island	15:14	2	491118	1234718	491112	1234700	3	154	128	500
4	16-Oct-86	Porlier Pass	7:53	2.45	490400	1233606	490330	1233536	3	121	117	500
5	16-Oct-86	Porlier Pass	9:08	3.15	490324	1233548	490242	1233524	2	101	89	500
6	16-Oct-86	Porlier Pass	11:45	2.15	490354	1233430	490430	1233442	4	201	207	500
7	16-Oct-86	Porlier Pass	14:55	2.15	490318	1233254	490400	1233318	5	256	260	500
8	16-Oct-86	Porlier Pass	16:00	2.2	490018	1233324	490048	1233342	1	9	29	500
9	17-Oct-86	Active Pass	7:38	2.14	485430	1232112	485418	1232018	1	16	20	500
10	17-Oct-86	Active Pass	8:19	2.34	485506	1232254	485454	1232148	2	53	119	500
11	17-Oct-86	Active Pass	11:31	2.21	485536	1232306	485506	1232206	3	161	128	500
12	17-Oct-86	Active Pass	12:17	2.21	485600	1232118	485636	1232206	4	183	192	500
13	17-Oct-86	Active Pass	16:04	2.21	485912	1232500	485924	1232548	5	241	276	485
14	18-Oct-86	Sturgeon Bank	8:25	2.17	491106	1231806	491018	1231812	2	70	95	500
15	18-Oct-86	Sturgeon Bank	7:43	2.15	491000	123174?	490906	1231748	1	44	44	500
16	18-Oct-86	Sturgeon Bank	11:23	2.2	491054	1231848	491142	1231848	3	115	150	500
17	18-Oct-86	Sturgeon Bank	12:17	2.48	491212	1232006	491254	1232112	4	188	207	500
18	18-Oct-86	Sturgeon Bank	14:30	2.48	491100	1231806	491018	1231824	2	91	73	500
19	18-Oct-86	Sturgeon Bank	16:07	0.52	491406	1232448	191354	1232612	5	267	289	485
20	19-Oct-86	Halibut Bank	7:36	2.2	492348	1234036	492324	1233924	4	174	174	500
21	19-Oct-86	Halibut Bank	9:16	2.41	492242	1234430	492318	1234348	3	119	132	500
22	19-Oct-86	Halibut Bank	11:16	2.27	492224	1234206	492248	1234306	2	90	104	500
23	19-Oct-86	Halibut Bank	12:56	2.16	492006	1234330	492024	1234430	1	24	51	500
24	19-Oct-86	Halibut Bank	14:47	2.14	491930	1234518	491948	1234430	5	302	210	500
25	19-Oct-86	Halibut Bank	16:10	2.2	492224	1234206	492248	1234306	2	122	86	500
26	20-Oct-86	French Creek	9:20	2.19	492136	1232200	492124	1242100	1	29	49	500
27	20-Oct-86	French Creek	9:54	4.06	492148	1241918	492118	1241812	3	124	159	500
28	20-Oct-86	French Creek	12:13	2.26	492124	1242048	492124	1241936	2	62	64	500
29	20-Oct-86	French Creek	13:20	3.15	492136	1241736	492106	1241630	4	225	190	500
30	20-Oct-86	French Creek	15:27	2.16	492312	1242230	492218	1242112	5	256	264	500
31	20-Oct-86	French Creek	17:08	2.2	492230	1241718	492254	1241824	5	305	313	500
32	21-Oct-86	Hornby Island	7:36	2.17	493212	1243148	493248	1243230	4	199	188	500
33	21-Oct-86	Hornby Island	8:24	2.41	493212	1243442	493242	1243524	3	161	146	500
34	21-Oct-86	Hornby Island	10:38	2.36	493148	1243442	493206	1243554	2	73	108	500
35	21-Oct-86	Hornby Island	11:47	2.19	493124	1243454	493154	1243536	1	5	23	500
36	21-Oct-86	Hornby Island	15:53	2.2	492900	1243936	492924	1244030	2	97	75	500
37	22-Oct-86	AjaxExeterShoals	7:31	2.17	493806	1243830	493736	1243748	2	101	97	500
38	22-Oct-86	AjaxExeterShoals	8:28	2.24	493930	1243754	494000	1243936	3	120	134	500
39	22-Oct-86	AjaxExeterShoals	10:25	2.23	493842	1243806	493912	1243800	0	51	113	500

Appendix 3 continued.

Set	Date	Area	Start Time	Effective Fishing time	Start Latitude	Start Longitude	End Latitude	End Longitude	Depth Stratum	Start Depth	End Depth	Number of Hooks
40	22-Oct-86	AjaxExeterShoals	11:55	2.24	494012	1243742	493954	1243654	4	176	212	500
41	22-Oct-86	AjaxExeterShoals	13:37	2.14	493942	1243912	493906	1243842	1	20	29	500
42	22-Oct-86	AjaxExeterShoals	15:02	2.18	494030	1243724	494106	1243736	5	265	366	500
43	23-Oct-86	Cape Lazo	8:13	2.2	494612	1245324	494700	1245324	2	75	104	500
44	23-Oct-86	Cape Lazo	9:22	2.53	494500	1245554	494536	1245606	1	22	40	500
45	23-Oct-86	Cape Lazo	11:15	2.2	494742	1245230	494818	1245248	4	170	193	500
46	23-Oct-86	Cape Lazo	14:10	2.22	494912	1245312	494948	1245306	5	245	335	500
47	23-Oct-86	Cape Lazo	13:00	2.15	494700	1245300	494736	1245306	3	131	159	500
48	23-Oct-86	Cape Lazo	15:54	2.18	494700	1245324	494618	1245330	2	102	75	495
49	24-Oct-86	Cape Mudge	8:05	2.15	495906	1250706	495854	1250806	1	22	20	500
50	24-Oct-86	Cape Mudge	9:01	2.31	495818	1250806	495806	1250706	3	137	141	500
51	24-Oct-86	Cape Mudge	11:01	2.16	495906	1250618	495830	1250624	2	66	95	250
52	24-Oct-86	Cape Mudge	12:33	2.27	495912	1250530	495954	1250548	4	220	256	250
53	24-Oct-86	Cape Mudge	13:49	2.26	495848	1250548	495936	1250548	4	177	198	250
54	25-Oct-86	Oyster River	11:50	2.17	495318	1250248	495300	1250200	4	170	209	500
55	25-Oct-86	Oyster River	12:35	2.45	495200	1250136	495112	1250106	3	165	134	500
56	25-Oct-86	Oyster River	14:50	2.31	495212	1250248	495136	1250236	2	110	106	495
57	25-Oct-86	Oyster River	16:04	2.18	494948	1250148	495012	1250218	1	24	49	500
58	27-Oct-86	Sinclair Bank	7:56	2.21	494136	1241636	494200	1241718	2	62	108	500
59	27-Oct-86	Sinclair Bank	8:31	2.29	494112	1241724	494148	1241706	3	154	163	500
60	27-Oct-86	Sinclair Bank	11:38	2.22	494200	1241812	494242	1241818	4	209	176	500
61	27-Oct-86	Sinclair Bank	12:25	2.56	494600	1241948	494600	1242042	1	16	13	500
62	27-Oct-86	Sinclair Bank	14:38	2.44	494236	1241836	494300	1241906	5	227	298	500
63	27-Oct-86	Sinclair Bank	16:42	2.17	494206	1241718	494136	1241630	2	55	101	500
64	28-Oct-86	Grants Reef	6:42	2.2	495112	1244436	495118	1244530	3	135	110	500
65	28-Oct-86	Grants Reef	7:20	2.45	495148	1244554	495212	1244642	1	49	33	500
66	28-Oct-86	Grants Reef	9:28	2.3	495130	1244600	495136	1244700	2	101	106	500
67	28-Oct-86	Grants Reef	11:14	2.15	495012	1244524	494954	1241618	4	178	209	500
68	28-Oct-86	Grants Reef	14:30	2.26	494742	1244812	494724	1244848	5	348	366	500
69	29-Oct-86	Epson Point	6:59	2.17	493106	1240242	493036	1240212	1	27	15	500
70	29-Oct-86	Epson Point	8:00	2.25	492906	1240306	492854	1240206	3	161	134	500
71	29-Oct-86	Epson Point	10:07	2.28	492848	1240318	492818	1240242	4	188	203	500
72	29-Oct-86	Epson Point	11:23	2.19	492924	1240236	492906	1240142	2	99	97	500
73	29-Oct-86	Halibut Bank	16:09	2.13	492248	1234300	492218	1234230	0	88	135	500
74	30-Oct-86	Entrance Island	6:56	2.4	491054	1234548	491042	1234454	2	66	86	500
75	30-Oct-86	Entrance Island	7:56	3	491130	1234524	491142	1234430	4	187	203	500
76	30-Oct-86	Entrance Island	10:50	2.17	491030	1234530	491048	1234618	1	29	29	500
77	30-Oct-86	Entrance Island	11:47	2.22	491118	1234554	491124	1234648	3	161	121	500

Appendix 4. Bridge log from the October 15-30, 1989 spiny dogfish longline survey conducted. Effective fishing time in hours; all depths in meters; latitude and longitude in degrees, minutes and seconds.

Set	Date	Area	Start Time	Effective Fishing Time	Start Latitude	Start Longitude	End Latitude	End Longitude	Depth Stratum	Start Depth	End Depth	Number of Hooks
1	10-Oct-89	Entrance Island	11:42	2.17	491006	1234700	491124	1234736	2	55	101	500
2	10-Oct-89	Entrance Island	12:44	3.01	491030	1234642	491054	1234700	1	9	26	501
3	10-Oct-89	Entrance Island	1517	2.16	491112	1234542	491130	1234642	3	121	152	500
4	11-Oct-89	Porlier Pass	800	2.05	490354	1233436	490318	1233412	4	205	203	500
5	11-Oct-89	Porlier Pass	910	3.1	490006	1233306	490042	1233330	1	44	53	501
6	11-Oct-89	Porlier Pass	1130	2.2	490230	1233500	490312	1233506	3	121	154	500
7	11-Oct-89	Porlier Pass	1320	2.2	490036	1233218	490118	1233348	2	73	88	500
8	12-Oct-89	Active Pass	715	2.3	485430	1232118	485418	1232006	1	27	49	500
9	12-Oct-89	Active Pass	814	2.51	485506	1232254	485500	1232200	2	59	101	500
10	12-Oct-89	Active Pass	1035	2.1	485524	1232230	485600	1232354	3	126	137	500
11	12-Oct-89	Active Pass	1206	2.39	485600	1232118	485636	1232206	4	187	196	500
12	12-Oct-89	Active Pass	1347	2.13	485836	1232436	485918	1232436	5	232	276	500
13	13-Oct-89	Sturgeon Bank	720	2.09	491030	1231754	490948	1231754	1	42	51	502
14	13-Oct-89	Sturgeon Bank	810	2.43	491106	1231806	491024	1231812	2	73	88	500
15	13-Oct-89	Sturgeon Bank	1032	2.43	491112	1231854	491024	1231854	3	122	116	500
16	13-Oct-89	Sturgeon Bank	1245	2.3	491130	1232012	491206	1232036	4	173	187	500
17	13-Oct-89	Sturgeon Bank	1435	2.1	491200	1232206	491212	1232300	5	231	260	500
18	14-Oct-89	Halibut Bank	707	2.25	492324	1233924	492342	1234012	4	178	174	500
19	14-Oct-89	Halibut Bank	801	3.23	492254	1234324	492230	1234230	0	106	113	500
20	14-Oct-89	Halibut Bank	1044	2.21	492300	1234448	492336	1234430	3	135	161	500
21	14-Oct-89	Halibut Bank	1425	2.1	492018	1234324	492048	1234354	0	37	101	500
22	14-Oct-89	Halibut Bank	1500	2.35	492030	1234612	492030	1234712	5	238	337	500
23	15-Oct-89	French Creek	715	2.05	492312	1242012	492324	1242118	5	254	254	500
24	15-Oct-89	French Creek	830	2.15	492130	1242054	492136	1241948	2	64	81	500
25	15-Oct-89	French Creek	1015	2.09	492300	1242024	492224	1241948	4	220	179	500
26	15-Oct-89	French Creek	1155	2.3	492136	1242206	492124	1242112	1	27	49	500
27	15-Oct-89	French Creek	1350	2.06	492148	1241930	492230	1242012	3	113	176	500
28	16-Oct-89	Hornby Island	805	2.22	493206	1243548	493236	1243636	3	121	128	500
29	16-Oct-89	Hornby Island	925	2.13	493218	1243654	493236	1243748	1	40	51	500
30	16-Oct-89	Hornby Island	1116	2.22	493248	1243812	493230	1243718	2	71	84	500
31	16-Oct-89	Hornby Island	1300	2.36	493436	1243648	493400	1243630	4	174	174	500
32	16-Oct-89	Hornby Island	1410	2.3	493154	1243600	493212	1243642	1	38	37	499
33	17-Oct-89	AjaxExeterShoals	727	2.05	493854	1243754	493924	1243836	1	51	45	500
34	17-Oct-89	AjaxExeterShoals	855	2.15	494018	1243742	493954	1243654	4	177	188	500
35	17-Oct-89	AjaxExeterShoals	1030	2.35	493854	1243748	493830	1243706	2	67	88	500
36	17-Oct-89	AjaxExeterShoals	1223	2.37	494124	1243842	494054	1243806	5	274	254	500
37	17-Oct-89	AjaxExeterShoals	1405	2.43	493830	1243624	493906	1243642	3	112	139	500
38	17-Oct-89	AjaxExeterShoals	1609	2	494048	1243800	494018	1243730	4	216	190	500

Appendix 4 continued.

Set	Date	Area	Start Time	Effective Fishing Time	Start Latitude	Start Longitude	End Latitude	End Longitude	Depth Stratum	Start Depth	End Depth	Number of Hooks
39	18-Oct-89	Grants Reef	730	2.15	494942	1244524	495018	1244548	4	201	170	500
40	18-Oct-89	Grants Reef	855	2.5	495006	1244336	495048	1244400	3	161	159	500
41	18-Oct-89	Grants Reef	1044	3.31	495124	1244512	495106	1244524	2	104	60	500
42	18-Oct-89	Grants Reef	1303	4.03	494842	1244518	494818	1244600	5	234	271	500
43	18-Oct-89	Grants Reef	1519	3.41	495148	1244548	495212	1244642	1	53	33	500
44	19-Oct-89	Sinclair Bank	915	2.05	495142	1241630	494206	1241706	1	55	59	317
45	19-Oct-89	Sinclair Bank	1043	2.07	494248	1241906	494212	1241836	5	275	249	500
46	19-Oct-89	Sinclair Bank	1203	2.05	494148	1241700	494230	1241718	2	60	92	500
47	19-Oct-89	Sinclair Bank	1341	2.24	494242	1241824	494206	1241812	4	181	196	500
48	19-Oct-89	Sinclair Bank	1458	2.12	494242	1241736	494318	1241800	3	128	137	500
49	22-Oct-89	Cape Mudge	1224	2.01	495836	1250536	495918	1250542	4	178	210	500
50	22-Oct-89	Cape Mudge	1314	2.42	495854	1250636	495930	1250642	1	51	57	400
51	22-Oct-89	Cape Mudge	1516	2.18	495836	1250542	495912	1250606	3	146	152	500
52	22-Oct-89	Cape Mudge	1647	2.02	495930	1250648	500000	1250724	2	64	88	500
53	23-Oct-89	Oyster River	830	2.19	495254	1250218	495124	1250130	4	174	205	500
54	23-Oct-89	Oyster River	1000	2.3	495224	1250306	495224	1250406	2	106	99	500
55	23-Oct-89	Oyster River	1136	2.16	495224	1250054	495212	1245954	5	240	256	500
56	23-Oct-89	Oyster River	1313	2.45	495230	1250230	495200	1250148	3	135	145	500
57	23-Oct-89	Oyster River	1514	1.51	495100	1250412	495048	1250324	1	27	51	500
58	24-Oct-89	Cape Lazo	750	2.07	494518	1245548	494542	1245630	1	33	24	500
59	24-Oct-89	Cape Lazo	857	2.36	494700	1245236	494730	1245324	3	146	132	500
60	24-Oct-89	Cape Lazo	1057	2.18	494606	1245442	494636	1245406	2	70	86	500
61	24-Oct-89	Cape Lazo	1225	3.03	494712	1245118	494754	1245200	4	187	205	500
62	25-Oct-89	Cape Lazo	1437	2.04	494700	1245012	494630	1244930	5	243	271	500
63	25-Oct-89	Epson Point	825	2.06	493100	1240242	493036	1240218	1	27	26	500
64	25-Oct-89	Epson Point	942	2.28	492818	1240300	492842	1240348	5	245	258	500
65	25-Oct-89	Epson Point	1130	2.44	492912	1240142	492936	1240248	2	104	106	500
66	25-Oct-89	Epson Point	1320	2.4	492812	1240212	492742	120148	4	172	220	500
67	25-Oct-89	Epson Point	1530	1.57	492924	1240242	492854	1240212	3	110	146	500
68	26-Oct-89	Entrance Island	1121	2.09	491206	1234606	491100	1234518	4	194	187	500
69	26-Oct-89	Entrance Island	1204	1.23	491124	1234600	491006	1234506	2	72	101	500